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OTTAWA

Field-Naturalists' Club.

TRANSACTIONS No. 1.

Ottawa, Canada:
Citizen Printing and Publishing Company, Sparks Street.

1880.

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OTTAWA

FIELD-NATURALISTS' CLUB.

TRANSACTIONS No. 1.

OTTAWA, CANADA:
CITIZEN PRINTING AND PUBLISHING COMPANY, SPARKS STREET.
1880.

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Patron:

HIS EXCELLENCY THE GOVERNOR-GENERAL.

President:

LIEUT.-COL. WM. WHITE.

Vice-Presidents:

J. FLETCHER. | W. D. LESUEUR, B.A.

Committee:

W. P. ANDERSON, C.E. | W. HAGUE HARRINGTON.
W. R. BILLINGS. | J. MARTIN.
H. BEAUMONT SMALL, M.D.

Secretary-Treasurer:

R. B. WHYTE.

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LIST OF MEMBERS.

Ami, H. M., *B.A.*
Anderson, W. P., *C.E.*
Anderson, Mrs. W. P.
Arnaud, E. D.

Bauset, E.
Bell, James
Bell, J. H., *M.A.*
Bell, W. D. M.
Billings, B.
Billings, W. R.
Bucke, E. F.
Butterworth, C. A.

Campbell, Wm.
Chesterton, W., *A.C.A.*
Chisholm, A.
Chrysler, F. H., *B.A.*
Clark, T. M.

Davy, R. A., *C.E.*
Dixon, F. A.
Duffy, A. J.

Ewart, D.

Ferguson, H. A.
Fleming, Sandford, *C.E.*,*C.M.G.*
Fletcher, J.
Fletcher, Mrs. J.
Fortescue, L.
Fortescue, Mrs. L.
Fraser, A.

Garrett, A.
Gordon, J. McD.
Grant, J. A., *M.D.*, *F.R.C.S.*, *Edin.*
Grant, Geo. W.

Gray, H. H. O.
Greata, J. M.
Griffin, Mrs. E.

Haliburton, R. G., *Q.C.*
Hamel, F. M., *C.E.*
Hamilton, L. A.
Harrington, W. H.
Harrington, Mrs. W. H.
Hawke, J. T.
Hector, Thos.
Heron, G. C.
Hine, E.

Jones, E. A. D.
Johnson, E. V., *C.E.*

Kemp, Rev. A. F., *M.A.*, *LL.D.*
Kilgannon, A. P.
Kingsford, Wm., *C.E.*

Leggo, W.
Le Sueur, W. D., *B.A.*
Lindsay, A.

McLaughlin, S.
Mara, E. A.
Martin, J.
Matheson, D.
Monk, J. B.

Newby, Frank
Nicholson, Vernon

Patton, Rev. H. B.
Pettegrew, W. S.
Plunkett, Jas.
Porter, H. C.

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LIST OF MEMBERS.—*(Continued.)*

Riddell, W.R., *B.A.*, *B.Sc.*, *F.B.S.E.*
Rinfret, A. P. A.
Ripley, C. J.
Robertson, P.
Rogers, C. C.

Scott, W. L.
Seymour, Miss
Small, H. Beaumont
Small, H. B., *M.D.*
Stewart, J. Cunningham
Symes, P. B.

Thorburn, John, *M.A.*, *LL.D.*
Todd, A. H.
Tomlinson, J., *C.E.*

Watts, J. W. H., *A.C.A.*
Watters, H.
White, Geo. R.
White, *Lt.-Col.* Wm.
Whyte, E.
Whyte, G. C.
Whyte, J. G.
Whyte, R. B.
Wicksteed, R. J., *LL.D.*
Wiggins, E. Stone, *M.D.*
Wood, H. O., *P.L.S.*
Wright, A. P., *M. Inst. C.E.*
Wright, Miss F. M.
Wright, Miss K. L.
Wright, W. R.

CORRESPONDING MEMBERS.

Macoun, Prof. Jno., *F.L.S.*, Belleville.

Saunders, Wm., *Presdt. Ont. Ent. Soc.*, London.

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OTTAWA FIELD-NATURALISTS' CLUB.

RULES.

I.—*Name and Object.*—This Club shall be called the OTTAWA FIELD-NATURALISTS' CLUB, and its object shall be the study of the Natural History of this locality.

II.—*Management.*—The Club shall be under the management of a Council, annually elected, consisting of a President, two Vice-Presidents, a Secretary-Treasurer, and a Committee of five other members. all of whom shall be eligible for re-election; three to form a quorum, Minutes of the meetings and proceedings of the Council to be duly kept.

III.—*Annual Meeting.*—The Annual Meeting of the Club shall be held on the third Tuesday in March; at which, in addition to other business, the Annual Report of the Council shall be read, and the officers for the ensuing year elected by ballot, after nomination.

IV.—*Special Meetings.*—A Special General Meeting of the Club may be called by the Council; and shall be called on requisition of not less than ten members, specifying the business they wish brought before the meeting. The Council shall call the meeting within fourteen days from the receipt of the requisition, giving one week's notice. No other business shall be transacted than that mentioned in the notice.

The Council may, however, summon a meeting for the transaction of general business at any time.

V.—*Proceedings.*—Excursions in Summer and Evening Meetings in the Winter shall be held; all arrangements for which shall be made by the Council.

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VI.—*Members.*—Ladies and gentlemen desiring to join the Club shall send a written application, signed by the applicant and two members, to the Secretary, who shall bring the same before the next meeting of the Council for approval.

VII.—*Corresponding Members.*—The Council shall have the power of electing Corresponding Members, who shall be persons not residing in Ottawa or its immediate vicinity, but who may be desirous of promoting the objects of the Club. Corresponding Members shall not be required to pay membership fees.

VIII.—*Annual Fee.*—The annual membership fee shall be fifty cents, payable in advance, due on the third Tuesday in March; and no member in arrears shall be entitled to any of the privileges of the Club. New members to pay the fee for the current year upon signing the roll.

IX.—*Special Tickets.*—Special tickets for non-members who may wish to join an excursion may be granted by the Secretary, on the application of a member, and under such limitations as the Council may prescribe.

X.—*Amendments.*—No Rule shall be enacted or amended except at a special meeting of the Club, called for that purpose, and by a two-thirds vote of the members present.

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ANNUAL REPORT.

To the Members of the Ottawa Field-Naturalists' Club :

The Council to whose care, twelve months ago, you entrusted the management of the Club, in laying before you a report of the year's transactions, have great pleasure in being able to congratulate you upon the satisfactory conclusion of the first year of the Club's existence.

As many of you were not members of the Club in the early part of the year, it will not be out of place here to give a brief sketch of the principal events connected with its early history. For two or three years back, several young men interested in Natural History discussed the possibility of starting a society in this city devoted to the investigation of the natural history of the vicinity. Nothing was done, however, till last winter, when it was resolved that an effort should be made. Circulars were sent to the members of the Ottawa Literary and Scientific Society, calling a meeting of all those favorable to the formation of such a society. To the great gratification of those interested, fully forty gentlemen attended the meeting held on the 19th March, 1879. After a lengthy discussion as to the form the organization should take, the Ottawa Field-Naturalists' Club was born and started in life with the following list of officers :—President, Lt.-Col. White ; 1st Vice-President, James Fletcher ; 2nd Vice-President, Prof. W. R. Riddell ; Secretary, R. B. Whyte ; Committee, W. P. Anderson, J. Martin, J. A. Guignard, B. Small, W. H. Harrington. Prof. Riddell and Mr. Guignard having since then resigned their positions, Mr. W. D. LeSueur and Mr. W. R. Billings were elected to fill their places. The Council-elect met and drew up a code of rules for the guidance of the club, which was subsequently ratified by a general meeting called for that purpose.

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During the year there were two general meetings of the Club, the one just mentioned, and another to consider the resignation of Prof. Riddell as second Vice-President. The Council met twenty times during the year for the transaction of business, at irregular intervals, as occasion required. When it is stated that the average attendance at these meetings was nearly seven out of nine councillors, you will see that the Council have not neglected the duties entrusted to their care.

The principal business that occupied their attention during the summer, was in connection with the excursions, of which there were five. It is not within the limits of this report to give a detailed account of these excursions, nor is it necessary, as the first Vice-President, in his inaugural address to the winter course of evening meetings, so well and fully described all the points of interest connected with them. It will suffice here merely to mention the localities visited, the dates on which the excursions were held, and the number that attended. The first was to Kingsmere, in the Chelsea Mountains, on May 22nd, attended by 42 members and friends. The second was a joint excursion with the Montreal Natural History Society to Calumet, on June 12th, 28 persons leaving Ottawa. No. 3 was to Dominion Springs and the Mer Bleu, on July 19th, at which there were present 28. No. 4 was a Saturday afternoon excursion to Britannia, the least attractive of the season, as it only brought out 25, including visitors. The fifth and last was to Meech's Lake, four miles beyond Chelsea, on October 9th, at which there were present 29, including non-members.

The Council feel compelled to express their regret that, although these excursions were to the most interesting places in the neighborhood, and the price of tickets put so low, that three of them did not pay expenses, so few of the members thought them worth attending. It does not say much for the interest the members take in the Club's work, that, with a membership of over eighty the average attendance at the excursions should be only thirty, fully one-third of whom were visitors; and they hope that during the coming season the excursions will be better supported by the members of the Club.

Besides the regular Club excursions mentioned above, some seventeen members were enabled, through the kindness of Dr. Wicksteed, to

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make a Saturday afternoon visit, on August 2nd, to Duck Island, seven miles below the city.

The only other event of interest concerning the Club during the summer was the very creditable exhibit made at the Dominion Exhibition, when the following prizes were taken by its members: In the botanical section, the 1st by the 1st Vice-President and the 2nd by the Secretary. Mr. W. H. Harrington took 2nd prize for his collection of insects, and Mr. Gilbert Heron an extra prize for his collection of shells, while Dr. J. A. Grant's exhibit of fossils and Mr. W. L. Scott's of native birds' eggs were highly commended by the judges—a record of which a young Club like ours may well feel proud.

Our winter course of Soirées, of which the last was held last night, has been very successful in every respect. At each of these, with one exception, two papers were read, many of them the result of personal observation, and illustrated by original diagrams and specimens. The papers read covered a wide range of subjects, as will be seen from the following list, and were listened to by fair audiences, the average attendance being about 55.

The following are the titles of the papers read: Monday, November 24—Inaugural Address, Mr. J. Fletcher; Graphite of the Ottawa Valley, Mr. W. H. Harrington. Monday, December 15—On the forms and structures of some Spongillæ found in the Ottawa, Dr. A. F. Kemp; The connection of Botany with Mythology, Mr. R. G. Haliburton. Friday, January 16—Cystidian Life, Dr. J. A. Grant; Museum Education, Mr. H. B. Small. Friday, February 6th—On the Contractility of the Spores of Palmella Hyalina, Dr. A. F. Kemp; Asbestos, Mr. W. P. Anderson. Friday, February 20th—A Practical Demonstration of the Human Brain, Dr. J. A. Grant. Friday, March 5th—Design in Nature, Mr. W. D. LeSueur; Land and Fresh Water Shells of the Ottawa Valley, Mr. G. C. Heron. Monday, March 15th—On some Insects captured at our excursions, Mr. W. H. Harrington; On some Plants collected during our excursions, Mr. J. Fletcher.

At most of these Soirées there were on exhibition botanical and other specimens collected during the summer by members of the Club.

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In addition to our regular course of Soirées, the Council, as a token of the good feeling which existed between the Ottawa Literary and Scientific Society and the Club, offered to take charge of one of the Conversaziones in the Society's winter course of meetings. Their offer was accepted, and the entertainment took place on January 9th. The programme consisted of an address by the Chairman, Mr. LeSueur; a series of chemical experiments illustrative of the phenomena of combustion by Mr. Henry Watters; an essay on coal by Mr. W. H. Harrington; recitations by Mr. J. Martin and Mr. W. Campbell, and an exhibition of natural history specimens in the Museum by members of the Club.

The membership of the Club has steadily increased, and now consists of ninety ordinary and two corresponding members—Prof. J. Macoun, of Belleville, and W. Saunders, Esq., of London, President of the Entomological Society of Ontario—who were elected by the Council according to Rule 7.

The following donations have been received during the year: 5 copies of the "Canadian Entomologist," No. 5 containing a notice of the organization of the Club, from the editor; Reports for three years of the Manchester Field-Naturalists' Club and of the Scientific Students' Association, of the same place, from Mr. W. R. Billings; 2 volumes of the proceedings of the Nova Scotian Institute of Natural Science from Dr. Honeyman, per Mr. W. P. Anderson; report of the Fruit-Growers' Association for 1879, containing the report of the Entomological Society of Ontario for the same year, from Mr. J. Fletcher. We have also received from the Curator of the Literary and Scientific Society a long list of donations made by the members of the Club to the Museum of that Society during the year.

The Council have on several occasions discussed the feasibility of printing the papers read before the Club during the winter, with an account of the excursions and the annual report as the transactions of the Club for 1879-80. The following extract from the minutes of last Council meeting expresses the view of the Council in the matter, which they commend to the favorable consideration of their successors.

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"Moved by Mr. Billings, seconded by Mr. Harrington, 'That, in the opinion of this Council, it is desirable that the papers read before the Club during the past season, including the Inaugural address and Secretary's report, which dealt with the original researches of members, or with the Natural History of the Ottawa district, should be printed as the Transactions of the Club for the year 1879-80.' Carried."

The following is the Financial Statement for the year, showing a balance on hand of $28.54 :—

DR. *The Treasurer in account with Ottawa Field-Naturalists' Club.* CR.

To	Members' Subscriptions.	$38 50	By	Stationery and Postage..	$ 7 93
	Excursion Receipts.....	88 05		Printing.....	19 00
	Soirée Receipts	23 70		Excursion Expenses....	89 28
				Soirée Expenses.....	5 50
				Balance, Cash on hand..	28 54
		$150 25			$150 25

R. B. WHYTE,

Secretary-Treasurer.

OTTAWA, March 16th, 1880.

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FIRST SOIRÉE.

INAUGURAL ADDRESS

DELIVERED ON MONDAY, 24TH NOVEMBER, 1879, BY JAMES FLETCHER, FIRST VICE-PRESIDENT O.F.N.C.

Members of the Ottawa Field-Naturalists' Club; Ladies and Gentlemen:

The unexpected absence of our President during the past week has thrown upon my unworthy shoulders the responsibility of addressing you this evening. I shall merely remind you of what we have done during the past year, and draw your attention to what we propose to do during the coming winter season.

Our Club was formed in the commencement of the summer, with the express object of working up the Natural History of this locality. We started under the most favourable auspices. His Excellency the Governor-General graciously consented to be our Patron, and the first circular, addressed to the members of the Ottawa Literary and Scientific Society, was answered by about forty gentlemen. At the first general meeting, the gentlemen whose names are printed on the first sheet of the programme were elected as the Council. This meeting, and all subsequently, were held, as is this one to-night, in the Museum of the Ottawa Literary and Scientific Society, to whom, for their courtesy, we are under a debt of the deepest gratitude. The only return given for this kindness was a promise of duplicate specimens to be collected by the Club, and I am happy to say that, at the end of the season, I shall be able to add many valuable specimens, and even collections, to their Museum from this source. During the summer, we have held five Excursions into the country, choosing a different destination each time. The first of these was to Kingsmere, in the Chelsea Mountains, and was of the most pleasant kind, and many valuable additions were made to the collections of the members. Perhaps the gem of the expedition was the lovely *Clematis verticillaris*, or "Purple-flowered Virgin's Bower." The lucky discoverer of the first specimen was Master Ernest LeSueur, whose quick eyes detected it as it lay half concealed among the leaves and loose stones. The members of the Club experienced much kindness at the hands of Col. and Mrs. Dennis, who, nothing daunted at the formidable array of 42 members, insisted upon the whole party coming into their lovely garden by the lakeside, and making tea for them. Besides plants, there were also a few insects collected by Mr. Harrington, and some shells by Mr. Heron. The second expedition of the Club was not one of the regular meetings, but was in answer to an invitation, very kindly sent by the members of the Montreal Natural History Society, to join them in a field day at Calumet. Our members were most successful at this excursion, carrying off all the three

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prizes offered by the Natural History Society for botanical specimens, the first being taken by Mr. R. B. Whyte, the second by Mr. B. Small, and the third by Mr. H. M. Ami. This trip was much enjoyed by all who participated in it, and it is to be hoped that it is only the first of a long series of joint annual excursions.

The third excursion, and, perhaps, the most interesting of all, was to the Dominion Springs and the Mer Bleue. This remarkable locality presents a field of unusual interest to the naturalist, and many rare specimens were collected; of the plants the most interesting were *Microstylis ophioglossoides*, *Dalibarda repens* and *Triglochin maritimum* var *elatum*. On the 2nd of August, Dr. Wicksteed invited the members of the Club to take a trip in his steam yacht. About twenty availed themselves of the opportunity and paid a visit to Duck Island, a few miles below the city. The fourth excursion was to Brittania, where a pleasant afternoon was spent; the locality, however, was too near to Ottawa to offer many new specimens.

The next important item to mention in the history of the Club is the exceptionally fine exhibit which they sent to the Dominion Exhibition, when the following prizes were taken:—In the Botanical Section, all the prizes offered: the first, a silver medal and $8, being taken by the First Vice-President; the second, $4, by the Secretary. In the Entomological Section, Mr. Harrington took the second prize of $10; the first, a gold medal, being awarded to the Entomological Society of Ontario, a well-established institution of many years' standing. Besides the above, a bronze medal, an extra prize, was awarded to Mr. Gilbert Heron for a beautiful collection of land and fresh-water shells. The finest collection exhibited in the name of the Club, however, was Dr. J. A. Grant's case of twelve unique fossils, every one of which was of unusual interest; these were not entered for a prize, but were highly commended by the judges. Another beautiful collection was one of native birds' eggs, exhibited by Mr. W. L. Scott. This also obtained a special mention by the judges.

During the Exhibition week, the members of the Club received an invitation from the President of the Entomological Society of Ontario to attend the annual meeting of that Society, of which many availed themselves.

The last excursion was to Meech's Lake, in the Chelsea Mountains, in the beginning of October. The day was a charming one, but the collections were small, the only find of importance being a new shell called *Physa Lordi* by our indefatigable conchologist, Mr. Gilbert Heron.

This is, I think, a brief summary of what we have done towards effecting the work we laid out for ourselves in the beginning of the season. The programme, which has been sent to all the members, shews what the Council

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propose to offer you during the winter, by the way of amusement, and to keep up an interest in the Club, which has already given us so much pleasant intercourse. One of the chief benefits bestowed by an organization, such as ours, is that it enables one always to know where to find a sympathetic companion. Of all recreations, there is none, to my mind, more enjoyable than a walk in the country with a congenial friend. No kind of intercourse brings you into closer contact with a companion than taking a walk. You cannot take ten steps, even with a stranger, without feeling a necessity of saying something, and, if there is anything in a man, you can soon bring it out of him in a country walk. Now, it is very clear that a judicious choice with regard to your companion is a most important matter; but it is not always easy to find one who has the same tastes or takes an interest in the same subjects as yourself. John Burroughs, in "Winter Sunshine," writes as follows: "Professional walkers are very fastidious in choosing or admitting a companion, and hence the truth of a remark of Emerson that 'you will generally fare better to take your dog than to invite your neighbor.' Your cur dog is a true pedestrian; he enters into the spirit of the enterprise; he is not indifferent or preoccupied; he is constantly sniffing adventure; laps at every spring; looks upon every field or wood as a new world to be explored; is ever on some new trail; knows something important will happen a little further on; whatever the spot, or whatever the road, he is always satisfied with it. In short, is just that happy excursive vagabond that touches one at so many points, and whose human prototype in a companion, when such can be found, robs miles and leagues of half their power and fatigue."

The most interesting companion in anything is undoubtedly the one who can tell you most about it. Therefore, the best companion in the country must be a naturalist, who can point out objects of interest and explain their beauties and wonders. No one looks upon the world so kindly as he does; no one else gives so much attention to, or takes so much enjoyment from, the country as he does, and he holds a more vital relation to nature, because he is freer, and his mind is more at leisure. Moreover, when a naturalist gets a friend, who is not one, out in the country, he feels a sort of móral responsibility resting upon him to find something particularly interesting to point out, so as to arouse his curiosity, and, if possible, to convert him to the study of "La Belle Science." I say particularly interesting, because everything in nature is interesting and beautiful; and I defy anyone to bring me a single object, picked up by a country roadside, which is not beautiful, and even exquisitely so—a stick, a piece of straw, a leaf, or a stone, it matters not what, if properly examined and understood, they are all wonderful and lovely. Let us briefly consider these common objects one at a time, taking them in the order I have mentioned them. We will suppose, for the sake of demonstration, that the stick is part of the stem of a young Canadian Sugar Maple (*Acer saccharinum*). This tree belongs to that division of the vegetable kingdom known as Exogens, or plants which increase by the deposition of a layer of new wood on their outer surface, beneath the bark, at regular periods. A plant stem, in its simplest state, consists merely of parenchymatous

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cells, with, occasionally, a central vertical cord of fibre cells, as, for instance, in the mosses. Such a stem, however, would be unsuited to plants in which great strength is required, and we, accordingly, find that, in all plants above the mosses, the stem is made up partly of parenchymatous cells and partly of woody tissue and vessels of different kinds, by which the requisite toughness and strength are produced. In these stems, then, we notice two systems—the *parenchymatous*, or common cellular system, and the *fibro vascular*. Vegetable cells are divided into two groups. When they are of such form that, combined together, their ends merely come in contact without perceptibly overlapping, they are called *parenchymatous;* but when elongated and pointed at their ends, so that, in combination, they overlap each other, they are termed *prosenchymatous*. But these extreme forms are connected by all sorts of transitional ones. Formerly, all elongated organs found in plants were supposed to have an entirely different origin from the cells, and were described under the names of woody fibres and vessels or ducts. It is now, however, known that they are all derived originally from ordinary cells. The parenchymatous system grows in any direction, according to circumstances, either longitudinally, by which the stem is lengthened, or horizontally, by which it is increased in diameter. The fibro-vascular system only grows longitudinally, and thus forms cords and bundles, which are distributed vertically in the midst of the parenchymatous to strengthen the stem. The parenchymatous is, therefore, termed the horizontal system of the stem, and the fibro-vascular the longitudinal, or vertical system.

In the embryo state, the stem of an exogen is entirely composed of parenchyma; that is, a tissue composed of simple cells with thin walls, whose length does not exceed their breadth, or in which the proportion of the two diameters does not vary to any great extent. As soon as growth commences, some of the cells become developed into spiral vessels and wood cells, forming, at the end of the first year, a zone, consisting of two parts, the first composed chiefly of spiral vessels, and known as the *medullary sheath*, and outside this, and closely connected with it, another part, composed of wood cells; this zone is formed round the central mass of parenchyma, which, from this time, we will call the *pith;* it is not, however, a perfect circle, for it is interrupted at certain points by projections of the pith in radiating lines, which pass through it and connect with an, external layer of parenchymatous tissue, which is called the *bark*. We have, then, as the result of one year's growth:—1. A central mass of parenchyma, which is called the *medulla*, or pith; 2. An interrupted zone of wood cells, and vessels forming the *wood*; 3. The radiating lines connecting the pith with the bark, called the *medullary rays;* and 4. An external zone of parenchymatous cells or the *bark*. Such is the structure of all exogenous stems which die yearly.

But our stick does not belong to an annual exogen; the stems, however, of plants which live more than one year, at first resemble those that die yearly, except that the wood formed is generally firmer and in larger proportion. During the second year, another zone of wood is formed on the outside of the one of

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the previous year, while, at the same time, a new fibrous layer is added to the inside of the bark. These layers are developed out of the vitally active cells of the *Cambium layer*, which is situated outside of the indefinite vascular bundles which form the wood. The medullary rays, at the same time, increase by addition to their exterior ends, and thus continue to keep up their connection between the pith and the bark. In succeeding years we have, in like manner, new layers of wood and fibrous bark, one of each every year; and the medullary rays also continue to grow from within outwards; there are also other medullary rays, which connect each annual zone with the bark; these are called *secondary medullary rays.* Each succeeding yearly growth is, therefore, a repetition of the first, except as regards the pith; this never increases in size after the first year.

The second object is the piece of straw. Not a few of you, I imagine, will be surprised to hear me call a stalk of wheat a tall, symmetrical, tower of stone surrounded by a casing of wood; such, however, with all propriety, it may be called. It will be at once seen that, to keep the grain from the moisture of the ground, in order that it may ripen properly, a tall stem must be developed; and also in the case of most of the economic grain-bearing grasses, which produce such enormous crops in comparison to the size of the plants, that it must be of exceptional strength to bear the weight of the copious ear. Nature has effected this by a most beautiful and unexpected process. The cuticle in some plants, but especially in these which we are considering, has its cell walls impregnated with *silex*, or flint; so much so, that when all the organic matter has been removed by heat or prolonged masceration in diluted nitric acid, the forms of the cuticle cells, hairs and stomata are distinctly marked out in silex, and can be beautifully displayed under the microscope, with the aid of polarized light. Such silicious cuticles are also found in the husks of the grains yielded by these plants, and the hairs, with which the *paleæ* or chaff scales of most grasses are furnished, are strengthened by a like deposit. Moreover, the vegetable cells produced in straw are prosenchymatous and form fibrous-tissue, which, added to the silicious skeleton, and the shape of the stem, a hollow cylinder, give the great strength and flexibility necessary. A stem of wheat straw is, perhaps, one of the strongest structures, for the amount of substance in it, which can be found in nature. An ordinary thick stem would, of course, support the weight of the ear as well, but, as the seeds of these plants were to form the large portion of the food of the human race, which they do, it was necessary to provide them with stems which would take up as small an amount of space as possible. I have no doubt that, did the members of the grass tribes cover as much area, in comparison to the amount of fruit they produce, as other plants, the whole world would not suffice as a field to grow the amount annually required to sustain man.

Our next object is the leaf. There is no part of a plant, not even the flower, with its wealth of beauty and delicious scent, which deserves more careful consideration, nor which performs more important functions than the foliage, the source of that great charm in the landscape, which all feel so keenly in the spring, when nature has spread, with lavish hand, her mantle of refreshing green

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over the trees of our forests, which have been gaunt and bare for so long during the dreary months of winter. For the better understanding of the special functions of the leaves, let us, for a moment, glance at the life history of a plant. The seed, containing the germ, is placed in the ground; under the influence of the warmth of the sun and a certain amount of moisture, the embryo which it contains begins to develop, and sends down a radicle into the soil, and a stem bearing the plumule, or little bud of undeveloped leaves, upwards to the light; at the same time the cotyledons or seed-leaves are formed. We have, then, a central axis developing in two opposite directions, the lower part is called the *descending axis* or root, and the upper the *ascending axis* or stem. Upon this axis or its divisions all the future organs of the plant are arranged; those which immediately succeed the cotyledons are the true leaves, and all which succeed the leaves in the way of development, such as the flower and its parts, are merely modifications of the leaves, designed for special purposes; therefore, the three organs which existed in the embryo in a rudimentary state are called the *fundimental organs* of the plant, or *organs of nutrition*, because they have for their object its nutrition and development. As a general rule, the plantlet exists ready formed in the seed. This can be easily seen by soaking a bean in water for a day or two and then opening it with a penknife, when there will be found a miniature stem and a pair of leaves, which need only be brought to the light to attain their green color. It has now only to form a root to fix it in the ground, when it becomes a perfect, though diminutive, vegetable. This root, though, can only be formed from proper material; neither water nor anything else which the plant is imbibing from the earth will answer. The proper material is prepared food, more or less of which is always provided by the parent plant and stored up in the seed, in the form of starch or similar nourishment, and generally deposited in the cotyledons or seed-leaves.

For a short time, this small stock suffices to support the young plant, and, by the time that is exhausted, it has formed roots and true leaves, and is, by their means, able to take care of itself.

The articles which form the diet of plants are exceedingly simple; they are water, carbonic acid, and ammonia. As soon as the young plant has expanded its green leaves, it absorbs these substances, from the soil by its roots and from the air by its leaves. It will not be difficult to understand what the organic constituents of plants are, and how the plant obtains them. A leaf consists of two parts: a woody and a cellular; the former is the framework of ribs and veins which serve to strengthen it, and also to act as canals to bring in the ascending sap, and to distribute it by the veinlets throughout every part. The cellular portion is the green pulp, and is nearly the same as the green layer of the bark; so that the leaf may properly enough be considered as an expansion of the fibrous and green layers of the bark; the whole is covered by a transparent skin called the epidermis. The green pulp consists of cells of various forms, usually loosely arranged so as to leave many irregular spaces or air passages, communicating with each other throughout the whole interior of the leaf. The

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green color of vegetation is due to a peculiar green matter, lying loose in the cells, in the form of minute grains, named *chlorophyl*, which is merely the Greek for *the green of leaves.* The use of the leaves is to convert the crude watery matter sucked up by the roots into proper vegetable substance. They have been compared, because of this, to the digestive organs of animals, and, as their functions are respiratory as well, they have been compared also to the lungs.

A large portion of the moisture which the roots of a growing plant are constantly absorbing, after being carried up by the stem, is evaporated by the leaves. To prevent a too copious evaporation of this moisture, they have been provided with the delicate tissue of cells termed the epidermis.

The greater part of the moisture exhaled escapes from the leaf through the *stomata* or breathing pores ; these are small openings through the epidermis into the air chambers, establishing a direct communication between the air chambers and the external air; through these, the vapour of water and the gaseous constituents of the atmosphere can freely enter or escape, as the case may be. The openings of these breathing pores are guarded by a pair of thin walled cells, which open when the weather is damp, so as to allow exhalation to go on ; but promptly close when it is dry, so as to arrest it before the interior of the leaf is injured by the dryness. These stomata or mouths, too, are the entrances through which the plant receives its food. I have already mentioned that the chief materials which compose the food of a plant are carbonic acid, water—that is hydrogen and oxygen—and a little ammonia. The substance of which vegetable tissue, namely the walls of the cells, is made, is, by chemists, called *cellulose*, and is just the same in composition in the hardest wood of a full grown tree as in the soft cellular tissue of a succulent plant; it is composed of carbon, hydrogen and oxogen. These, then, are necessary materials for the vegetable growth, and must be received by all growing plants, and it only remains to be shewn whence the plant obtains them. Of all substances consumed by a plant, water is taken in to a far greater extent than any other, chiefly through the roots, but also, to a small degree, through the leaves. Now, water is composed of oxygen and hydrogen, two of the three elements of cellulose, and, strangely enough, these two gases exist in water in exactly the same proportion as they do in cellulose. It is perfectly apparent, then, that the plant obtains two of the three elements of cellulose from water, the other, carbon—by far the most important—is the only one now to be found.

Among the components of the atmosphere, there is one which is exceedingly injurious to animal life, which is called *Carbonic acid*, or more usually now Carbonic dioxide; this gas consists of carbon and oxygen and is the product of combustion. In breathing, which is one form of combustion, animals are constantly forming carbonic acid gas by uniting the carbon of their bodies with the oxygen which they inspire ; it is then exhaled as carbonic acid gas. It generally exists in the atmosphere to the amount of $\frac{1}{2500}$ part of its bulk. This is not enough to prove injurious to animal life. But, with every breath, animals

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are diminishing the oxygen in the air, so necessary for them, and increasing the amount of carbonic acid, so injurious to them; or, rather, which would be so injurious if it were allowed to accumulate; the reason why it does not, is because plants consume it as soon as formed. Chemical experiments have shewn that, when the leaves and green parts of plants are exposed to sunlight, they possess the wonderful power of decomposing the carbonic acid of the atmosphere It is absorbed through the stomata, and the delicate cells are the chambers of the laboratory where it is decomposed, and the whole of its carbon is taken by the plant and assimilated with the water and other matters collected from the soil and air to form cellulose, which becomes wood, pulp, starch, sugar, etc., etc., according to circumstances, while the whole of the oxygen it contained is evolved back again into the air because useless to the plant, the full amount required by it to complete the composition of cellulose already existing there as one of the constituents of water. This is proved by the fact that there is a constant relation between the amount of carbonic acid gas absorbed and the oxygen exhaled. While the plant is a true apparatus of reduction, the animal is a true apparatus of combustion, in which the substances it derives from the vegetable are burnt and restored to the atmosphere in the form of carbonic acid, water and ammonia, ready to be again absorbed by the plant and to re-pass through the phases of organic life. The important influences exercised by vegetation on nature will be at once appreciated when it is remembered that this is the only known process by which oxygen gas, so essential to our existence, is restored to the atmosphere in a free condition. Thus we see that the two great organized kingdoms of nature are made to co-operate in the execution of the same design; each ministering to the other and preserving that one balance in the constitution of the atmosphere which adapts it to the welfare and activity of every order of being, and which would soon be destroyed were the operations of either of them to be suspended. It is impossible to contemplate so special an adjustment of opposite effects without admiring this beautiful dispensation of Providence, extending over so vast a scale of being, and demonstrating the unity of plan upon which the whole system of organized creation has been devised.

The last object of our collection is the stone. To anyone who has never examined a stone critically, it would appear to be a perfectly homogeneous mass, with no structure at all. This is seldom the case, however. Almost every solid, when slowly deposited from a liquid or aëriform condition, assumes a definite symmetrical shape, called a *crystal*. The perfect crystal represents the natural condition of a substance, and the form peculiar to each is one of its most important characteristics. The idea of symmetry is inherent in every human mind, it may be more or less cultivated by experience; but the germs of the idea are found in the most untutored. However rude his condition, man is pleased with a symmetrical arrangement of objects, and his mind is offended when his eye detects a violation of the laws of symmetry, although he may have no name for the idea. Corresponding with this idea, we find symmetry everywhere in nature. The parts of an animal are most symmetrically arranged round the body, as also

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are the leaves round the stem of a plant; but nowhere is the idea of symmetry so fully developed as in the mineral kingdom, where everything is arranged in the most beautiful and perfect regularity.

The reason I have dwelt at such length this evening on these objects is to endeavor to point out that there is nothing, not even the commonest object in nature, that is not worthy of a careful examination. It is a great mistake, but a mistake which is often made, even by scientific men, to suppose that new knowledge can be gathered only from the unexplored fields of science, when, in the most familiar walks of life, there are countless riches of truth which the reapers, in the hurry of the harvest, have passed unnoticed, and which will abundantly reward the careful gleaner. The French aptly express this thought in the provrb "*La Science court les rues*"—Science runs the streets;" or, more freely translated, Knowledge is to be found everywhere, by those who will look for it, for it is so plentiful that it runs in the very gutters of the streets.

Now as to the effects or defects of a special study. There is much to be said on both sides of this question. There are many classes of students in the natural sciences. The largest of these are: *Firstly*, those who study merely for the pleasure it gives themselves and their friends, and the furtherance of knowledge generally; and *secondly*, those who study simply for the furtherance of knowledge in some special branch.

There is, besides, another class, who are hardly worthy of the name of scientific students, who do so simply for what they can make out of it, in the way of reputation, or even money; this last class, I am glad to believe, however, is very small.

To the first class most belong. This is that class which embraces all those who, appreciating the beauty and splendour of the objects revealed in a study of nature and the amount of true pleasure they can thus enjoy, acknowledge the responsibility which is upon them, and strive to induce others to study it too, and so participate in the pleasure which they know is so real. These men make utilitarianism their chief object, first, to make themselves useful to others, and then to induce these, in their turn, to do the same. To gain this end they strive particularly to be as interesting as possible to everyone, always ready to give a helping hand, or explain anything they themselves understand to those who do not. The work of these students is to popularise science, and to remove, as much as possible, that veil which the very word seems to have drawn over itself. I do wish that word "science" had never been invented. I am convinced that there are more turned aside from the study of natural science by it than by anything else. People seem to think that, when anything is spoken of as a science or an "ology," that it is something requiring special adaptations and much study to

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at ain, and, consequently, from preoccupation, or other reasons, consider it is beyond them. Science simply means knowledge; but it has now gained a significance in the eyes of many of something abstruse and not to be had by all. This impression I consider it the duty of all of us to endeavor to clear away.

To the second class belong those who take up a special branch of natural history, and, paying little attention to others, push their investigations to the furthest possible limit, giving their whole time to it. They may have the intention of taking up other branches when they have thoroughly studied the first, but here the impossibility of doing everything, and the sh ortness of man's life, interfere, and they find that, unless their labors were undertaken with the express object of establishing some fact, or throwing a light upon some connected study, that they have wasted their whole lives and furthered the general work of science very little. Now, the former class is composed of the generous students of nature, who use their time in popularizing and making pleasant the by-ways of science; the latter, of the unselfish, (if a distinction can be drawn between the two words generous and unselfish) who give their whole time to the dry and difficult task of solving knotty points, the clearing up of which may or may not, eventually, be of value. Now, one of these is not more important than the other, for they are both essentially necessary in order that the work of science may go on and prosper. Specialists are particularly useful, and, in fact, everyone must be a specialist to a certain extent, for the different branches of natural science are so intimately connected that, to understand one thoroughly, you must know a little of all. The proper system is to choose very deliberately which branch you intend to take up. Look into all, and find which you have the greatest taste for, then set to work and work it up from its commencement beginning at its very elements, and work on slowly; you will soon find that you require, frequently, to know something of the other branches. Now comes the critical point. Do not drop it altogether; you do not want to make a study of all. Let the first compose the backbone of your studies, and work the others round it; but remember you only want the rudiments of the other branches, not to know all about them, but enough to help you to understand your own. This is the great secret of progress: keep on steadily at your one branch, and, at the same time never allow anything which affects it to pass unexamined, even though in another branch, until you quite understand the connection. Take as instances: Where would the Entomologist be without a knowledge of Botany, to know where to look for insects which he knew to feed on a certain plant, or a slight knowledge of Mineralogy to know in what description of places to find the plant; or, again, the Conchologist: how would he know where to spend a day looking for specimens, could he not discriminate whether there were or were not lime in the soil, in some form, from which the shells could be formed; or the Geologist, how could he identify his specimens if he knew nothing of

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Botany, Conchology and Entomology? These are a few of many instances that might be quoted, but they shew how one branch depends upon the others for support. Let us, then, cast our lot in with the first class, and strive, while working up the natural history of our neighborhood thoroughly, to do so in a popular manner, intelligible to all. I believe we have it in our power to give much happiness to many, by inducing them, by our example and persuasions, to study with us Nature. Its wonders are open to everyone, from the young child to the aged man; it offers charms and fascinations to all—for all is wonderful and beautiful; and, as nothing makes men so happy as contemplating the beautiful, I consider nothing is so well calculated to make men good and happy as a study of nature.

Through the kindness of the Rev. Dr. Dawson, Principal of McGill University, Montreal, I am enabled to exhibit some beautiful microscopical slides, in illustration of some of the points I have brought before your notice this evening.

"GRAPHITE OF THE OTTAWA VALLEY.—MR. W. HAGUE HARRINGTON."

[The first half of this paper, treating in a general manner with the composition, mining, manufacture, etc., of graphite in other countries, has necessarily been omitted.]

Turning now to the more special consideration of the deposits of graphite found in this section of the Dominion, which is known as the Ottawa Valley, it will not be going beyond the limits of the subject if, at the outset, we give a momentary glance at the formation and character of the rocks in which they occur.

The Archæan era in geology includes the oldest rocks known to that science—rocks which are supposed to have been formed from the original rocky crust produced by the cooling of the earth. They are easily seen to be the result of the disintegration of an older series, and frequently contain pebbles unlike any rocks now known.

In Canada, where these rocks are very fully represented, they are divided into two periods—the Laurentian and the Huronian—the former being considered the oldest. The long chain of mountains, of which a portion is visible across the Ottawa, is composed of the Laurentian rocks, the estimated thickness of which is 30,000 feet, consisting, with few exceptions, of metamorphic or crystalline rocks.

These rugged, broken hills, which lift their stony crests above the pines that clothe their sides, contain immense masses of nearly every species of mineral. The three at present most worked and valuable are iron, apatite and graphite, the latter being most frequent in the limestone. In this series of

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rocks there are three great limestone layers, separated by gneissoid rocks, aggregating not less than 3,500 feet in thickness. The limestone of each of these layers is often mixed with, or passes into, rocks which consist largely of pyroxene, or hornblende, and these portions abound frequently with valuable minerals, the most common being mica and graphite.

As to the probable origin of the graphite in these rocks, Dr. Dawson remarks that "It may fairly be assumed that in the present world and in those geological periods with whose organic remains we are more familiar than with those of the Laurentian, there is no other source of unoxidized carbon in rocks than that furnished by organic matter, and that this has obtained its carbon in all cases, in the first instance, from the deoxidation of carbonic acid by living plants. No other source of carbon can, I believe, be imagined in the Laurentian period."

When we come to consider the enormous deposits of carbon held by the Laurentian rocks, it will easily be seen that immense periods, even of a most prolific vegetation, must have been necessary for their formation. The atmosphere of that period must have contained a great amount of carbonic acid, and the seas have been charged with abundance of carbonate of lime, and have contained, in common with the land surface, enormous expanses of vegetable life. The amount of carbon, in the form of graphite, in the Laurentian system, is considered by Dawson to equal that (in the form of coal) of equal areas in the carboniferous.

In the Township of Buckingham a band of limestone, with some thin interstratified bands of gneiss, about six hundred feet in thickness, occurs, and is filled to such an extent with veins, or disseminated crystals and scales of graphite, that the mineral is estimated to constitute one-fourth of the whole in places, and, allowing for the poverty of some portions, the total vertical thickness of pure graphite can not be less than from 20 to 30 feet. It occurs in equal abundance at several other horizons in beds of limestone, estimated by Logan to have an aggregate thickness of 3,500 feet; and the total quantity thus contained can readily be seen to be enormous.

Unlike beds of coal, which occupy the place where the forests which produced them formerly flourished, graphite has been disseminated through the rocks by changes therein. In some places, to be sure, beds are found so regular and pure that they may be fairly compared to deposits of anthracite; but these are the exceptions; the great bulk of the mineral is scattered in scales, lumps or thin veins. Many of these veins are mere shrinkage cracks, traversing in countless numbers the containing rocks, and so irregular in size as often to resemble strings of nodular masses.

The graphite contained in these is supposed to have flowed into them in the form of a hydro-carbon; or it may have been in a state of aqueous solution at an enormous heat. It is evidently derived from the rocks traversed by the veins, and has deposited with it sediment from these beds Hence there is no occurrence of fossils as in coal, and the vegetable origin of graphite can only be inferred from analogy, and from the fact of a few scanty organic remains, as those of eozoon, having been found in the containing rocks. * * * *

The graphite of the Buckingham district occurs in three distinct forms, always in or in close proximity to bands of crystalline limestone. First, in foliated scales or plates in limestone, gneiss, pyroxene or quartzite, and sometimes even in iron ores, as is the case at Hull; secondly, in distinct embedded masses, or pockets in the limestones; thirdly, in veins traversing in every direction the containing rock.

The first form is most common, and occurs in greatest abundance in the limestones, often forming such large deposits as to possess great economic value, as at Buckingham.

The second form is of common occurrence, and has been worked in Buckingham and Lochaber, where the deposits are considerable. In the latter town-

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ship the bed which has been mined is over ten feet in thickness, and yields about 20 per cent. of pure material.

The last, or fissure graphite, is not so common, and, though of much greater purity and brightness, cannot, in general, be worked to such profit.

The series of rocks in which graphite and its companion minerals occur in this district has been described by Vennor, in a letter to Dana, as follows: "The order, then, thus given to the economic minerals just mentioned is, in ascending order, as follows: first, hematite iron ore; secondly, magnetite and apatite (unimportant); thirdly, magnetite and hematite (important); fourthly, plumbago (very extensive); fifthly, phosphate of lime, with iron ore (an extensively worked belt); and then, sixthly, eozoon Canadensis in abundance, with serpentine, chrysotile, and veins of baryta and galena. You will thus observe that iron ore runs through the series, though most important in one horizon; that plumbago, with a great deal of pyrites, is toward the upper portion, while the great body of apatite-bearing rocks is at the very summit."

It is said that plumbago was mined to a small extent in the vicinity of Grenville as long ago as thirty years, and that the farmers around Buckingham were accustomed to use the purer specimens, which they picked up, for polishing their stoves with. No mining worth speaking of, however, was done until a New York company opened a mine in the Township of Lochaber, where they purchased a number of plumbago deposits and erected factories, at an expenditure of about $50,000. After working for four years they were compelled to cease.

The Montreal Company commenced operations about the same time. They invested about $150,000, and made some large shipments to England and New York. They manufactured immense quantities of "Dome" stove polish, but about eight years ago they closed work, and soon afterwards their buildings were all burnt down. Difficulty of transportation was one main cause of the failure of these companies, and this, although somewhat remedied of late, is still a great source of expense and trouble.

The principal mines recently in operation were those of the Dominion of Canada Company, discovered about ten or twelve years ago by Messrs. Pennock and Devine. This company (which claimed to have started with a capital of £100,000, subscribed largely by English capitalists) owned about two thousand acres of land, containing very rich deposits. Among these are about fifteen lodes or rich veins, one of which (in lot No. 21 in the 7th con.) is stated by Vennor to vary in thickness from one to two feet; it runs in a W.S.W. direction, and contains very pure graphite.

The deposits of disseminated mineral were, however, found to be more easily and profitably operated. The quarry worked was about one-eighth of a mile in length and about seventy feet in depth, and yielded from ten to sixty per cent. of plumbago. The machinery in use was capable of turning out about fifteen tons per week.

The graphite, when received at the mill, was broken into lumps weighing about three pounds and then crushed. It was afterwards separated into different grades by passing through large tubs about fifteen feet in diameter, known as "muddlers," in which the heavier particles are deposited in the centre and the lighter ones toward the outside edge. After being dried in an oven, it was ground and separated, as in a grist mill; the coarse grades being packed in barrels for crucibles, and the finer in tin boxes for pencils, electrotyping, etc.

About five years ago the foundation of the factory was laid by Hon. R. W. Scott, and the little settlement which has since grown up around it rejoices in the appropriate, if somewhat high-flown, name of Graphite City. It contains, beside the factory, a post-office, blacksmith shop, saw mill and boarding-houses.

The Buckingham Mining Company owns about one thousand acres of land, and had commenced active operations three or four years ago, but did not erect factories, and is now doing little or nothing.

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In 1877 three hundred tons of disseminated mineral were taken out by Mr. Miller in the ninth range of Buckingham, but for want of a market he was compelled to suspend work.

In the same year, a mine, said to be very rich, was also discovered and slightly opened by Thomas Lynch, about three miles from the Dominion of Canada mine.

The graphite obtained from these mines is, from its purity and other qualities, eminently adapted for all the uses to which plumbago has been applied. Granular graphite, such as was formerly obtained in Cumberland, and is now mined in other European countries, is suited chiefly to the manufacture of pencils, and for stock where strength is not needed, but it is almost useless for crucibles; while the foliated graphite of Ceylon is used entirely for the latter purpose.

The plumbago of this country, consisting, as it does, of both varieties, can be used for each and all of the numerous forms in which this valuable substance is employed. The Dominion of Canada Company were manufacturing all kinds and grades of crucibles, pencils, stove polish, etc. They claimed that their purest graphite contained ninety-seven per cent. of carbon, and that the pencils, crucibles and other stock made from it were equal to any produced elsewhere. Owing to great commercial depression, this company was compelled to suspend operations, and became bankrupt. The diminished production of iron caused a great decrease in the demand for plumbago crucibles for steel smelting, and prices in consequence, dropped from $250 per ton to $75 or less. At present, appearances point to a decided revival of the iron industries, and, when we learn that 8,000 tons of plumbago were used yearly by one English firm alone for manufacturing crucibles, we may hope yet to see a good demand and profitable prices for our graphite. * * * * *

SECOND SOIREE

On Monday, 15th December, 1879, Rev. A. F. Kemp, M.A.; LL.D., delivered a very interesting address (oral) "On the Forms and Structures of some Spongillæ found in the Ottawa." Three species of these fresh-water sponges were stated to be found in the river viz: *S. Ottawensis, S. Dawsonii and S. Asperima.* Two at least of these species can be gathered in McKay's Bay, below the city. The structure and distinguishing characteristics of the different forms were clearly explained, as also the methods of their growth and reproduction.

"The connection of Botany with Mythology" was the title of a paper read before the Club on the same evening by Mr. R. G. Haliburton, *Q.C.* It dealt with the origin and influences of the belief, common to ancient nations and to the uncivilized tribes of the present day, in a "Tree of Life." Versions of such traditions still existing among the North American Indians, Australians, Polynesians and other races were given in illustration. The paper clearly showed evidence of much research into the Mythology of the past and present.

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THIRD SOIRÉE.

FRIDAY, 16TH JANUARY, "CYSTIDEAN LIFE" J. A. GRANT, M.D., F.R.C.S., EDIN. F.G.S., LONDON, ETC.

Mr. President, Ladies and Gentlemen:

In compliance with the request of the President and Council of the Ottawa Field-Naturalists' Club, I have very great pleasure indeed in being here to-night, as an old citizen of the capital of the Dominion of Canada, to throw my mite into the scale and assist in the development of the work of natural history. To the young, I know of no subject of greater importance than that of the cultivation of the observation which is necessary in the study of Nature and Nature's laws. I should like very much, in our educational institutions, to have impressed upon the minds of the rising generation the necessity for ocular demonstration and careful observation as regards the various objects that are constantly being presented to our youth on every side throughout the paths of life. There is no part of the whole Dominion of Canada, with reference to the subject of natural history, that takes a more important place as an evidence of creative power than the city of Ottawa. In our rocks, on every point, we find entombed the records of animal and vegetable life; there is not a stone wall, a stone hedge or a macadamized road throughout the length and breadth of the city that is not made up of organic remains. And let me tell you, ladies and gentlemen, that we have reason, from more than one point of view, to feel proud of this section of the country, from the amount of scientific information that has been contributed, not only to the people of Ottawa, but to the whole civilized world, as regards the work of palæontological investigation. Some of the old workers, who have now gone to their long homes, have done much towards building up the subject of palæontology, and certainly I can speak of no name with a greater degree of pride and gratification than that of the late Mr. Billings, who was one of the very first workers in the subject of natural history investigation in Canada. His writings are well known everywhere. His name is a household word; you cannot pick up any volume without finding the name of the late Mr. Billings largely quoted. It ought to be to us, as Ottawa people, a source of pride and gratification to think that this very institution has been in itself a germ and nucleus for the development of that department of natural science which the youth of this section of the country have reason to look forward to with no ordinary degree of gratification. The time was—25 years ago, when I first became interested in the subject of geology—that really it was somewhat dangerous for an individual to take hold of a stone, no matter who he might be, for fear of being called a lunatic—in fact, not to be trusted in society, because he undertook the pleasure of observing what was in Nature's book. This volume here in the valley of the Ottawa is an important one; you cannot examine even the cover without finding, as it were, photographed views of flora and fauna, such as are not only to be observed by the naked eye, but to be closely tested by the microscope. I will, to-night, bring before you only one of the species of cystideæ, and offer to you a few observations upon it, but, before doing so, permit me to say that I am pleased to know that the Government of Canada have decided to remove the Geological Department of Canada from Montreal to Ottawa. And why? Because then the public men of the Dominion will have an opportunity of closely observing what is being done towards the development of the economic resources of our country. In every section of the Dominion there are mineral resources, and the Senators and the Members in their leisure hours will have an opportunity of comparing the products within their own immediate neighborhood with the products accumulated in geographical survey, and thus contribute to the development of the

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natural resources of this Dominion. Again, I have seen it mentioned, a few days ago, that we were to have a national museum, something after the style of the British Museum, or the Smithsonian Institution in Washington. Concerning this I do not know, but I am aware of the fact that the Government contemplates making a collection of the curiosities, if we might so term them, peculiar to the Indian tribes in North America. There is a very large collection now in British Columbia, and at Fort Pelly, under the control of the Department of the Interior, and I think it is the intention of the present Premier to have these articles brought here to form a nucleus for such a collection, and the day is not far distant when the Government of Canada may undertake the construction and formation of an institution such as the United States has in the Smithsonian Institution, and Great Britain in the British Museum. Before entering upon the description of this animal, I wish to draw your attention to the section in which we are now living. * * * * * * *

Of the strata which form the rock structure in the neighborhood of Ottawa City, the Trenton beds possess the greatest degree of interest, as far as the remains of animal and vegetable life are concerned. For convenience of description, the silurian rocks of Canada are divided into three—upper, middle and lower silurian. The latter are designated as Trenton by Dr. Hall, of the New York Geological Survey, and the term has been adopted by the Geological Survey of Canada. From this rockbed the late Mr. Billings made his world-wide reputation. Prior to his labors little was known of Canadian Cystideæ, and the decades of the Canadian Geological Survey form a record alike creditable to Canada and the name of one so closely identified with field-naturalists' work in this particular section of country. Cystideæ are known as a family of *Silurian echinoderms*, so called from their spherical or bladder-like form. In the primeval seas, they constituted the representatives of the sea-urchins of the secondary, tertiary and current epochs, and appear to have been furnished with a short foot-stock, and not to have been free moving, like the Cidaris or Echinus. According to the late Mr. Forbes, they are supposed to have affinities with the Crinoids on the one hand, and the sea-urchins on the other, and covered, like the Lily Enchrinites, with a coat of mail, richly ornamented, in many instances, with radiating ridges, or striæ. In 1843, Mr. Channing drew the attention of British geologists to these rare forms of life, many fragments of which were collected by the British Geologic l Survey of that date, and particularly in the explorations in South Wales. At this date comparatively little was known either as to the organization or zoological affinities of Cystideæ. In 1845, Von Buch, of Berlin, investigated carefully the peculiarities of cystideæ, the result of which has been much valuable information on these forms of life so rich in the neighborhood of Ottawa.

Anatomy of Cystideæ—Their structure is that of a more or less spherical body, with a *column* and *arms*. The body is covered with polygonal plates, closely fitting together, so as to invest the animal with a coat of mail, except at four points—superiorly at the mouth, inferiorly at the attachment of the stem to the body, centrally at the opening of the reproductive organs, which are generally covered by valves, and at an opening near the mouth, considered the termination of the alimentary canal. The body of the British species is usually small compared with the Canadian species, which vary in length and breadth from an inch and a half to two inches, and vary considerably as to shape, viz: globular, oval, pyriform, conical or subcylindrical. The plates are divided into three classes:—1st. Those which are definite in arrangement, and remain constant throughout the life of the animal, the shell enlarging, as muscular fibre enlarges, by the growth of the original plates, with the addition of new ones; 2nd. Those not definite in arrangement, or constant throughout the life of the animal, growth being effected by the enlargement of the old plates, as well as by the introduc-

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tion of new ones; 3rd. Those in which there is a combination of the definite and indefinite, the former on the dorsal side of the animal, the latter on the ventral. The plates which compose the outside or exoskeleton of cystideæ, are so arranged as not to close the orifices essential to the animal economy; at all other points they join completely, forming an exact covering for the protection of the body, and the maintenance of those parts performing the various functions of these peculiar animals. The surfaces of the plates are usually ornamented with grooves, striæ and rugosities, and occasionally exhibit pores, scattered singly or in pairs, which are supposed to serve as media for communication between the interior and exterior of the animal. The precise nature and function of these pores has not yet been perfectly ascertained. According to Forbes, there are only three pectinated rhombs found on the body of each cystidean, and their homologues have not been discovered in any section of the entire class of echinoderms. It is considered that the pectinated rhombs have situated on them ciliary organs, such as those found on the epaulettes of the larvæ of echini. The pores are usually disposed in rhomboidal figures, one-half in each contiguous plate, and every two pores of these rhombs are invariably united by small canals or grooves. These rhombs are considered so important that Professor Muller, of Berlin, has adopted them as a basis for classification. *The mouth* of this animal is an opening of moderate size placed on one side of the body, about its centre, but usually inclines towards either extremity. In some species it opened and shut by a sort of valvular apparatus, whereas, in others this peculiar arrangement is wanting. In cystideans provided with arms, the mouth is usually circular, and on its sides these appendages arise. In those species wanting arms, it is supposed that the mouth possessed a peculiar compensating power, by which it could protrude and retract its lips, and thus seize the material requisite for its digestive functions from the surrounding media.

The ambulacral orifice.—This constitutes one of the most important openings in the structure of this species. It is placed near the centre of the upper part of the body, and usually between the bases of the arms, when present. These peculiar openings were a subject of considerable discussion amongst naturalists, and now there is little doubt that those vessels which constitute the *ambulacral system* communicate from the exterior to the interior, and *vice versa*, through these openings, as in the madreporic canals and tubercles of asterids and echinids, such as defined by Huxley. Although no specimen containing the soft parts has ever been discovered, by which we might be enabled to demonstrate the communication more pointedly, still, the natural inference is, that an animal such as a cystidean, stationary in its character, and possessing as its chief part a large body, to be sustained and nourished, would have ample circulating media throughout, to receive from the thoracic centre that degree of nourishment requisite to sustain the various functions of this strange organism in perfect activity. The third small opening (anus), is very minute, and frequently not observed in certain genera in which the wear and tear of the system is supposed to escape through the mouth, as in some of the star-fishes.

The Arms and Pinnulæ.—For some time the arms of cystideæ formed the subject of a sharp controversy between Von Buch and Volbroth; the former denying the existence of these parts, while the latter adhered to the contrary idea. At present no one doubts the presence of arms in some shape or other. The Cystidean arms are considered to be like those of crinoids in many respects, although not remarkable for extensive development. For simplicity of description they are divided into three classes: 1st, Cystideæ, in which the body of the arm was not developed, but only the grooves and pinnulæ. 2nd. Cystideæ, in which the arms were developed, but bent backwards and attached to the body. 3rd. Cystideæ with free arms. This arrangement of arms must not be considered as an attempt at classification, for, on a closer examination of the genera, we find

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varied combinations of arms and pinnulæ, sufficient to point out any such division as of minor consequence.

Stem. The stems of cystideans are constructed much as the stems of crinoids, being, in fact, cylinders composed or made up of successive ring-shaped joints, which, as far as observed, become broader and thinner as they near the body of the animal, and frequently alternate in size, presenting a necklace-like appearance. British cystideans differ from Canadian ones in the respect that they present no traces of a stem except the point of attachment on the base of the bodies. The lower part of the stem is usually attached to the rock with which it is in contact, thus rendering the animal more or less a fixture, a peculiar fact in connection with its manner of life.

Having briefly adverted to the leading anatomical peculiarities of cystideæ I may here state that the particular specimen under consideration—"Comarocystites Punctatus"—(Billings) has free arms and the pinnulæ of a true crinoid, and,consequently, comes under the third class, as previously defined. The term Comarocystites is from comeron, a straw-berry, according to Billings, who first discovered, in this district, that portion of the animal remains which enabled him to determine the genus. According to the description (in Decade III, of the Canadian Geological Survey, 1858); "the body of this species is of an oval or pyriform shape, and in large specimens about an inch and a half in length. It is protected by plates, which have a deep concavity, occupying nearly the whole of the area of each, the effect of which is to cover the surface of the fossil with large rounded pits, an aspect that serves to distinguish it at the first glance from any other known in the Lower Silurian rocks of Canada. In certain states of preservation the sutures are marked by minute, thickly set, square or oblong rough punctations, which do not, however, appear to penetrate through to the interior. In some specimens there is only one, and in others two or three rows of these punctures upon each suture. The greater portion of the area of the plate is marked with deep fissure-like striæ, at right angles to the suture, and with their erect lamellæ or partitions between them. These are sometimes crossed by other lamellæ, parallel with the edges of the plates, the effect of which is to produce a peculiarly rough surface. Sometimes none of these are visible, and the surfaces of the plates are then uniformly smooth and solid. The mouth is large near the apex, and closed by a pyramid of five triangular valves. The arms are four in number, and consist of an anterior pair situated directly over the mouth, and a posterior pair placed opposite on the posterior side of the summit; a deep narrow grooves crosses the apex, in a direction from the anterior to the posterior side; from one end it sends up two branches into the anterior pair of arms, and from the other end, two into the posterior pair. The arms consist of a single series of joints, each about one line and a half in length; the pinnulæ are nearly cylindrical, and divided by joints, at lengths of one-half a line. There is but one pinnula to each joint, and only on one side. The column is rounded and smooth, formed of very thin joints, and does not, in a specimen with *three inches* preserved, *exhibit any signs of tapering*." Until 1864, when the first entire specimen came under my notice, nothing definite was known of the column. Its entire length is about 4½ inches, and at its lower part or terminal extremity, it presents a decidedly tapering appearance, and is more or less concave at its point of attachment and fully half an inch in breadth. Its length is about equal to that of the body and one of the arms combined.

From an examination of the column, the idea of cystideæ being fixtures is considerably strengthened. For a time naturalists inclined to the belief that the arms and pinnulæ of cystideæ alone acted as prehensile organs, but the most generally accepted opinion at present is that of Dr. W. B Carpenter, who considers that the large ciliæ within the alimentary canal are capable of producing a powerful indraught of water, sufficient to supply the requirements of the

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animal with nourishment quite independent of either arms or pinnulæ: Cystideæ, being attached firmly to the sea bottom by their columns, are supposed to remain motionless during the digestive process; accomplished while streams of water are received and ejected through the mouth as in the common starfish. Ciliary motion is likened to that of a cornfield when agitated by frequent gusts of wind. It is quite independent of the will of the animal and also of the life of the rest of the body. Such is the accepted opinion in man's organization.

The digestive process is one of the most important in every organism, and the material required is supplied in accordance with the necessities of the system. Under such circumstances, it does appear peculiar that the special duty of supplying the system of even a cystidean should be assigned to parts over which, by analogy, there is little or no control whatever. "Cystideæ being a race of small marine animals, which flourished vigorously during the Silurian period, and disappeared before the commencement of the Carboniferous era," I shall only briefly refer to some of the chief characteristics of their time. With few exceptions indeed, the fossil remains of cystideæ consist of mere fragments, notwithstanding the fact that, while the upper half of the Lower Silurian rocks of Canada, in which these organic remains flourished, were in process of formation, cystideæ swarmed in the bottom of the ocean, and, according to Barrande, formed entire beds, from one to two yards in thickness, in Bohemia. In 1852 only one specimen was known in the Lower Silurian rocks of Canada. At present there are at least 21 distinct species in the collection of the Canadian Geological Survey. From all the facts known, the belief is that cystideæ made their appearance amongst the first creations on the earth's surface, obtained the greatest degree of growth in the Lower Silurian formation, and died out at or about the dawn of the Devonian period. To the student of nature and nature's laws, the period of cystidean life is one of more than ordinary interest. To interpret fully nature's works we require to observe closely nature's operations at the present time. We can better form an idea of the past by comparing it with the present. Time obscures the upheaving action of central power when gradually brought about. In the case of the sudden earthquake, or unexpected volcano, matters are quite different, and the rapid change of physical points of interest gives quite a lively impression of passing events. The geological aspect of the immediate Ottawa section is quite an interesting chapter in the history of the pre-adamite world. The flora and fauna of the present do not in any sense surpass in interest those of the past, of which we have evidence in the upturned strata daily brought to view. In the Silurian period, and, in fact, long anterior, order, regularity and perfection as to form, in lower types, both in the animal and vegetable world, are well established facts. Life was then, as at present, governed by recognised laws, and the chemical and physiological principles involved were in many respects analogous to those we now enjoy. The vast chain of being is spoken of as a scale of "animal life," in which species succeed species in a regular series, both as to development and organization, from life's lowest forms to the very highest, where the genus homo is recognised as the chief order of creative power. The difficulties in the way of such a form of succession are not easily overcome. It may answer to treat of creatures in a linear form; however, the complex structure of even a cystidean on such an hypothesis would doubtless give considerable trouble in tracing its history. The great leading ideas which constitute the types of animal life (which I shall now briefly touch upon for the interest of some of the juniors in natural history) are four in number. The *Radiata* or star-like type of life, embodied in form, radiating from a centre, like the "starfish." The *Articulata*, composed of articulations, movable on each other, as the Trilobite or true crustacean. The *Mollusca*, of which we have a good example in the order Brachiopoda and the genus lingula. In this class there is a distinct quality of corresponding parts on the side

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of a central axis. This same class is represented by the ordinary clam, as well as the cuttle fish, of the present. Lastly, the *Vertebrata*, having a back bone, and, the skeleton being internal, constitutes the frame work, upon which the muscles act. Fishes, batrachians, reptiles, birds and mammals belong to this last and most important division of the Animal Kingdom, inasmuch as it includes man, the highest representative of vertebrate power. Thus we have the four leading types as indices in tracing the various sub-divisions which frequently perplex the student of natural history. In conclusion, I may here state that the nearest type to cystideæ, is the Silurian crinoid, which usually differs from the former, in being elaborately ornamented and supported by a much longer stem, fixed in its character, like the cystidean, and having functions in many respects alike. Thus these interesting forms of life played their part in this world's history, and lead us to coincide with the sentiment of the poet who has so beautifully expressed * * *

"'Tis hard to tell of work begun,
Of work completed, work undone,
And all the wonders that are wrought
By tiny agents of God's thought."

MUSEUM EDUCATION: MR. H. BEAUMONT SMALL.—The subject was chosen in connection with the removal here of the Geological Museum, and a graceful compliment was paid to Dr. Grant, for his unremitting exertions to accomplish this object. The origin and usefulness of museums was treated of, and the formation of local museums strongly urged, with a wish strongly expressed for the establishment of a national museum, which, as an adjunct to Government, may be eventually anticipated. The neglect hitherto shewn in all young countries with regard to such institutions may be traced to the intense worship of wealth compared with that paid to intellect, whilst the struggle of parties and factions contribute to this neglect. In order to be a naturalist, a man need not necessarily be highly educated. We may gather ideas from books, but we get them from nature direct; books and nature are a reflex of each other; the museum is their co-worker, and the information to be gained there from collected material is the index to what we have to acquire by patient and personal observation of nature. Public opinion has greatly changed with regard to science, and science and infidelity are no longer counted synonymous. Science is, in the present century, the magician's wand, and he who follows it is the magician of to-day.

FOURTH SOIRÉE.

FRIDAY, 6TH FEBRUARY, 1880.—"THE CONTRACTILITY OF THE SPORES OF PALMELLA HYALINA:" REV. A. F. KEMP, *M.A., L.L.D.*

A paper describing observations made by the writer during the autumn on this plant, which is a species of *Algae* found in the quiet

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waters of lakes and rivers throughout Canada. It was intended to publish this valuable contribution to the labors of the Club, but Dr. Kemp prefers to withhold it until, with an instrument of greater power, he has made more extended observations of the phenomena witnessed by him.

"Asbestos:" W. P. Anderson, *C.E.*

The paper was prefaced by an expression of regret that, in a district so rich in minerals and fossils as Ottawa, more serious attention was not bestowed upon the geological branch of Natural History, and a hope that the defect would be remedied to some extent during the coming season.

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Asbestos is a term used to denote a peculiar form assumed by several minerals, rather than to designate any particular species. Tremolite, actinolite, and other forms of hornblende containing little alumina, augite and serpentine, pass into fibrous varieties, all of which are popularly known as asbestos, though, technically, that name is restricted to the hornblende variety, while fibrous serpentine should be called chrysotile.

All these varieties are similar in appearance, the fibres, which run transversely of the veins and parallel to each other, looking, when compact, like mica. The color varies from pure white to gray, or greenish, and the texture of the separated fibres from that of coarse cotton to the finest silk. The longest fibre of which mention has been found came from Italy, and measured 44 inches. In Canada it is never found of any great length, the average being probably not over 1½ inches. The fibre has a soft, greasy feel. Specific gravity varies from 2·9 to 3·4. Before the blowpipe a single fibre fuses into a white glass globule, specimens containing most iron being most readily fusible. In masses it is infusible at ordinary temperatures. This property, together with its insolubility in acids, its being a bad conductor of heat, and the remarkable strength of its fibre, are qualities that make it valuable in several branches of manufacture.

To understand its chemical character it will be necessary to give some account of the rocks in which it exists.

In the lower members of the oldest groups of rocks, three minerals, hornblende, augite, and serpentine, are more or less widely distributed.

Hornblende consists of silica and magnesia, with a greater or less quantity of lime, protoxide of iron, and other oxides, and is usually found in a scaly form.

Augite differs from hornblende mainly in the shape of its crystals, and in containing, usually, a greater portion of lime and less magnesia.

Serpentine contains little or no lime, but has about 12 per cent. of water in its composition, in addition to the ingredients of hornblende.

All these substances are classed under the same head mineralogically—being non-aluminous silicates—and are, indeed, so closely connected that it is sometimes difficult for even the mineralogist to tell to which species a specimen should be referred.

Another fact that shews the close relation hornblende, augite and serpentine bear to one another is that, amongst themselves, they are frequently subject to pseudomorphism, a process by which the chemical character of a mineral is changed while it retains its original form of crystalization. There is no doubt

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that this process is sometime undergone in veins of asbestos, so that what may have been originally true asbestos is now chrysotile. Prof. Dana states that all crystalized serpentines are pseudomorphs. In the report of Dr. Harrington on some of the minerals of Ottawa County, in the Geological Report for 1877-78, instances are given of asbestos being an alteration product or pseudomorph of pyroxene.

The following table shows the results of analyses of the several varieties of Asbestos, with the localities from which the specimens came:

	Hornblende Asbestos, from Tarentaise.	Hornblende Asbestos, from Zillerthal.	Augite Asbestos, from Schwartzenstein, in Tyrol.	Chrysotile, from Reichenstein.	Chrysotile, from New Haven, Connecticut.	Chrysotile, from Montarville, New Jersey.
Silica	58.20	55.87	58.19	43.50	44.05	42.62
Lime	15.55	17.76	....	....	....	....
Magnesia	22.10	20.33	30.79	40.00	39.24	42.67
Protoxide of Iron	3.08	4.31	7.93	2.08	2.53	.27
Protoxide of Manganese	.21	1.12	....	....	....	....
Oxide of Alumina	.14	....	.18	.40	....	.38
Hydrofluoric Acid	.60	....	1.86	....	....	....
Water	.14	....	....	13.80	13.49	14.25
	100.02	99.89	98.95	99.78	99.31	100.19

The origin of the fibrous forms does not appear to be fully explained, but it seems probable that they were formed later than, and out of, the chemically similar rocks surrounding them. Dr. Hare explained, in a lecture delivered before the Literary and Scientific Society, that mineral veins were formed by water, or other chemical fluid, penetrating the rocks in which the minerals were disseminated, combining with them into new chemical compounds, and finally depositing them in fissures, where they had an opportunity of crystallizing. This would seem a natural way of accounting for the presence of the fibrous silicates now under consideration.

Or they may have been crystallized and deposited in the fissures which contain them, in some way by the action of the same heat that crystallized the surrounding rocks.

In Europe, asbestos occurs very abundantly, being found in Piedmont, Saxony, Switzerland, Salzburg, the Tyrol, Dauphiné, Hungary, Silesia; also in Corsica so abundantly as to have been used for packing other minerals; at St. Kevern in Cornwall, in Aberdeenshire, and in some of the islands north of Scotland.

On this continent it occurs in Greenland, and in nearly all of the United States, particularly in North Carolina, on Staten Island, at Baltimore, and at Montarville, N.J., the quality differing in different localities. There is said to be a gradual increase in the tenacity of the fibre in proceeding from Georgia northwards, this improvement appearing to culminate in northern Vermont,

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where the mineral closely resembles the finest European varieties, although it cannot approach them in length of fibre.

That occurring in Canada will be referred to hereafter.

There are some other very curious allied fibrous substances that deserve passing notice. *Mountain Leather*, a kind in thin flexible sheets made of interlaced fibres, and *Mountain Cork*, the same in thicker pieces; both so light as to float in water, and both often hydrous, or containing water in their composition. Another substance, known as *Mountain Wood*, is compact fibrous, varying in color from gray to brown, looking a little like dry or petrified wood. These are found generally in the same districts as the common varieties of asbestos. An interesting specimen of mountain leather has been found on the Grant lot, in Buckingham.

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An account of the history of asbestos, and its various uses in arts and manufactures was here given.

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As explained earlier, asbestos is an altered form of either hornblende, augite or serpentine, and wherever we find formations containing these substances, we may reasonably look for asbestos. These minerals are found abundantly throughout the older formations, the Laurentian and Lower Silurian. The country bounded on the south by the St. Lawrence and Ottawa Rivers is almost entirely Laurentian, while the remainder of the Province of Quebec embraces principally Lower Silurian rocks

As yet, comparatively little asbestos has been found, and the few discoveries that have been made are without exception of the serpentine variety, more properly known as chrysotile. It has been asserted that chrysotile fibre is useless for making fire-proof fabrics. It contains about 12 per cent. of water, and chemists explain that when exposed to flame the heat drives off this water, and so destroys the composition of the mineral. But notwithstanding this theory, the fact remains that Canadian chrysotile commands a price in the United States market, varying from $40 per ton for inferior grades, up to $120 for long and silky fibre, with a demand exceeding the supply.

The source of the Canadian asbestos of commerce is a narrow band of serpentine in the Quebec group, a series of rocks at the bottom of the Lower Silurian formation, and which runs from the Vermont boundary to the River Chaudière, through the Eastern Townships of Potton, Bolton, Orford, Brompton, Melbourne, Shipton, Cleveland, Ham, Garthby, Coleraine, Thetford and Broughton.

There is a mine being worked in Shipton, near the village of Danville, on the Grand Trunk Railway, from which a considerable quantity has been got out and sold at $60 per ton. The output of this mine for the next ten years has been contracted for.

The most successful mine in Canada was discovered in the autumn of 1877, in the Township of Coleraine, by a Frenchman, and is now owned by the Boston Packing Company, who, during 1878 and 1879, sent about 200 tons to their factory in Boston. In the spring of 1878, Dr. James Reed, of Inverness, and L. H. Goff, of Vermont, purchased a large tract of land adjoining this mine, and opened up several more. The district in this neighborhood in which asbestos is found is about three miles in length, northerly and southerly, by one in width. The rock formation is serpentine, with chromic iron ore. These gentlemen have sent samples to manufacturers in Europe, who, it is said, pronounce it the finest and strongest fibre known, and have sent out orders for large deliveries this year. English and American capitalists are negociating for the purchase of some of these mines.

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A good quality of asbestos has been found in Shefford, on the line of the Quebec Central Railway, which deposits Mr. Selwyn, the Director of the Canadian Geological Survey, pronounces the most promising he has seen.

On the Chaudière River good specimens of asbestos were got out as long ago as 15 or 16 years, and a small quantity has been exported from the Des Plantes River, a tributary of the Chaudière; but it has been impossible to obtain any definite information regarding this locality.

The whole quantity exported from all the district in the Quebec group of rocks cannot much exceed 300 tons, which realized an average price of $50 at the mines. There appears to be no question as to the profitable nature of asbestos mining operations in that belt of country.

In the Laurentian rocks the first worked was in a vein of serpentine, in Papineau Seigneury, near the village of St. André Avelin, from which, ten years ago, an American took out about five tons of 1-to 2-inch fibre, which was alleged to have been used in the manufacture of lamp wicks in Rhode Island. As no work has since been attempted at this opening, the inference is that it is exhausted. This locality is also celebrated as having yielded some of the finest specimens of Eozoon Canadense.

In Templeton I have heard of two workings—one upon the S. ½ of Lot 11, the other upon Lot 10, in the 8th Range, about 300 yards apart, and in the same band of serpentine. The seams of chrysotile—they are not sufficiently regulat be called veins—in some places run nearly parallel to one another, following the direction of the serpentine, in others they are curved, and even more or less reticulated. The width of the seams, and consequently the length of the fibre, here varied from a fraction of an inch up to three inches. The form in which the asbestos occurs has been very well described by the owner of one of the workings. He says "The asbestos occurs in a narrow vein of serpentine rock, which lies in a hill of coarse white crystalline limestone. We found the serpentine dipping towards the east. In places there would occur a great many narrow seams of asbestos, separated from each other by narrow veins of serpentine. Again, in places, several of these seams would run together, and we would get the asbestos with a fibre from one to two inches long, to be again separated into narrow seams."

A single ton was shipped from one of these mines last autumn, and realized $100, delivered free on board in Ottawa.

Among miners opinions differ as to the future value of the Ottawa Valley deposits. Some think the quantity in any one place so small, and the cost of separating the asbestos from the gangue of serpentine that encloses it so great in proportion, that, except for some unusually good croppings, the working would never be found profitable. Others are of opinion that large finds will be made, and that the mining of asbestos is destined to become an industry second in importance only to the mining of iron and apatite. With these I am disposed to agree, though my judgment is based merely on the geological character of the rocks and the analogies that exist between them and those of other districts where workable deposits are found.

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FIFTH SOIRÉE.

FRIDAY, 20th FEBRUARY, 1880: DR. J. A. GRANT, F.R.C.S., EDIN., gave a practical demonstration of "The Brain" and many of

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the members had, for the first time, an opportunity of seeing a human brain skilfully dissected, and its manifold parts beautifully and simply explained. The nerves, blood-vessels, ventricles, etc., were all shown, while, at the same time, their various functions and their connection with the bodily organs were made clear. The importance of carefully developing the brain, and maintaining it in health was strongly and eloquently urged.

SIXTH SOIRÉE

FRIDAY, 5TH MARCH, 1880: MR. W. D. LESUEUR, B.A., read a very interesting paper on "Design in Nature," in which, after dwelling on the spirit in which scientific investigations should be pursued, he proceeded to show the embarrassments in which scientific investigators had involved themselves by a determination to find in nature a confirmation of preconceived theories. He quoted largely, in illustration of this point, from the Bridgewater Essay of the Rev. Wm. Kirby, on "The History, Habits and Instincts of Animals," and concluded by explaining the view of nature taken by modern evolutionists.

"ON THE LAND AND FRESH-WATER SHELLS OF THE OTTAWA," MR. GILBERT C. HERON.

* * * * * * * * *

There is very little variety in the land and fresh water-shells of this district; and in this respect, it is very like the greater part of the Dominion of Canada. The reason for this want of number in species, as well as color, is the excessive heat and cold of our climate. While many of the shells are pleasing and the forms elegant, for the greater part they are but common, small in size, and want the fine coloring of those from the tropics. And those who have seen collections from uniformly warm countries, will, I fear, dispise the few specimens which occurred to me about Ottawa during the season of last year.

A shell found in all rivers and ponds about Ottawa, and yet not common, is *Paludina decisa*, Say. It will be found on clay and sandy clay shores, burrowing in the mud near the water's edge; a little dome of clay will generally indicate where to dig for this gasteropod. I found associated with it, a little below Gatineau village on the Ottawa, a very interesting little *Dymnaria-Pisidium adamsii* (?) It has never been found in Canada before, or at least it is not on the lists, and is very rare. *Valvata tricarinata*, Say, is very common, yet it is the most extraordinary of our shells, and cannot be mistaken with its three keels and delicate green color. The three-keel variety only is found here, so far as I know, but the species may be seen semi-fossil in the marl beds with one, two, and three keels, but as often plain. *Valvata humeralis*, Say, is found in vast numbers in the little pond, in Dow's swamp, near Billings' Bridge, but has not been met with elsewhere so far. This shell may be the same as *Valvata sincera*, Sav, but I have not seen a specimen of the latter, which is said to exist in the north-west

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of the United States. The animals of *Valvata tricarinata* and *humeralis* are the most beautiful that I know. Anyone who has examined them in a dish of water with a magnifier, and has seen their branched gills or lungs, of a delicate white color, thrust out over the head, and the whole body of elegant form arrayed in most delicate shades of green and gray, will agree with me in saying that they are to be placed among the most beautiful of living creatures.

The only *Melania* found here is *M.-liviscens*, which is very plentiful and has great variety in color and form. In the Rideau River it is generally olive and more perfect towards the apex than those in the Ottawa, which are sometimes of a rich brown, occasionally banded with darker revolving zones. There is also a difference in the shape of the aperture.

Very fine *Limnæa stagnalis* are to be found in the Rideau Canal, but it is common elsewhere.

Limnæa gracilis, Say, a shell new to the Canadian list, was found by me in the rapids above Billings' Bridge. I obtained two specimens, one very fine but dead, and the other but a fragment. I am sure there will be other specimens found, in the future, in this favored spot.

It is to be noticed that the fresh-water shells are not so constant in their characteristics as the land shells. This great variety in form, etc., has led to many mistakes in naming, and it is now said that *Limnæa elodes*, *umbrosa*, *reflexa*, *caperata*, *decolata* and *catascopium* are all one and the same shell.

Physa elongata, Say, is found everywhere during summer in dried-up ponds with *Sphærium occidentale*, under leaves and rubbish, but still alive. Many of the shells are very large, even larger than Mr. Say's specimens got in the State of Illinois. A few of my specimens were as much as eight-tenths of an inch in length. This shell is the same, I think, as *Physa hypenorum* of Europe.

I am again fortunate in being able to add two more shells: *Physa lordi*, Baird, and *P.-brevispira* to our lists. The last was found by the late Mr. Billings and named by Dr. Isaac Lea, but it was not generally known and was never put into any list, being considered but a variety of *P.-ancillaria*. It is the *P.-brevispira* of Lea, found by Mr. Billings, or a new shell. I am inclined to regard it as new, and, therefore, claim a place for it in our list. It is common in the Rideau River, about the rapids, and will, I think, be found in the Ottawa.

Physa lordi I found in Meech's Lake, among the mountains, fourteen miles north of Ottawa, in the month of October, on the occasion of our last excursion. This shell, I am told, has been found only in the mountains of Oregon and British Columbia. It appears to be confined to the mountainous districts; while *Physa heterostrophia* and *ancillaria* are only found on the plains and in the valleys. Meech's Lake is about 400 (?) feet above the sea, and is surrounded by the Laurentian rocks. It contains but few gasteropods. I only got five or six *Limnæa stagnalis*, and but one *Planorbis bicarinatus*, but there are vast quantities of small *Unio complanatus*.

The different species of *Planorbis* are generally plentiful in all ponds and rivers; but St. Louis Dam, Rideau Canal and River, are favorite haunts. *Planorbulina armigera*, Say, appears to be rare; I only found a single specimen during the season, and that dead.

The *Helices*, or land snails, are found in secluded, damp and fertile places. They are found in greatest number in hard-wood forests, especially when the old trees are cut down and there is a second growth of timber, and are a sure indication of fertility of soil; but not unfrequently by old fences, and along the banks of rivers under pieces of board. The last is the peculiar haunt of *Helix nitida* of Muller, now for the first time added to the Canadian list. I found my first specimens near the Hog's Back Rapids, on the Rideau River, but afterwards I found many more near the Show Grounds, on the Rideau Canal, in company with *Helix labyrinthica*, and *Vertigo ovata*, Say. *Helix Sayii*, Binney, does not appear to be so rare as in other parts of Canada. *Helix* (*Bulimus*) *lubrica*, Muller, is very com-

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mon. On the St. Lawrence and Ottawa Railway, six miles from Ottawa, I have collected hundreds from a single square foot of sod. Vast numbers are destroyed every spring, when the old dry grass is burnt by the track-men. In this section of country the frost leaves the ground about May 1st, and it is about ten days after this that the snails first venture into the open air for a short time at mid-day. If *Helix lubrica* is examined before the inhabitant ventures to stir, the aperture of the shell will be found closed by a thick yellowish substance. This is not an operculum, nor yet is it a part of the shell, but appears to have been built by the animal for winter use alone, since it is lost as soon as the weather gets warm. This must have been observed before, but I find no mention made of it in any work on shells.

Another very interesting shell is that of *Vetrina limpida*, Gould. It occurred to me in but two places: by the Rideau River, near Billings' Bridge, and in the Hull Mountains. It appears to require a still richer soil and more moisture than any of the other *Helicidæ*. It cannot be mistaken by any who have seen it, with its mantle thrown over the shell and up to the apex.

Many persons who have walked along paths and side roads in the country, after a warm shower of rain, are surprised to see a curious snail crawling in countless numbers. If the sun dries the ground quickly, many of them will be found to have cemented their houses to stones or hard gravel, waiting for more moisture. This shell is *Succinea obliqua*, Say. We have two other *Succineas*, but they are rare.

Pupas are found about Ottawa everywhere, and if their extremely small size is considered, the color being very often the same as the ground, it would not appear surprising to hear it said they are very rare. With one exception they are not rare, but only hard to find. *Carychium exiguum* is found in great numbers everywhere, and, although the smallest of our shells, it is not so difficult to discover, being always white. Our shell is the same as *C.-minimum*, of Europe.

Conchifera:—of the family *Unionidæ*, seven *Unios*, three *Margaritanas*, and three or four *Anodons*, occurred to me during last year. Generally the *Unionidæ* are not easy to get, and the best specimens are to be had only by dredging in deep water. All the specimens of *Margaritana* appear to be rare. The best places for collecting them are in the Ottawa at Duck Island, and in the Rideau at the Rapids, under the stones. At Britannia I got two varieties of *Anodon*, which may prove to be new shells.

There is another family of the *Conchifera*, which are very interesting. I refer to *Cycladidæ*. The shells of this family are very often taken to be young clams; in Scotland they are called "Buckies." They are very hard to classify, and it is only after much study that they can be identified. *Sphærium rhomboideum*, Say, is found in ponds by St. Louis Dam, also in Dow's Swamp; and, although found in considerable numbers in those two places, is not a common shell. Those found in the little lake, in Dow's Swamp, were almost white, while those got at St. Louis Dam were of the usual olive color, with yellow bands. This is the most beautiful shell of its class we have. The other species of this family are found almost everywhere—in still water, in rapids under stones, in mud, and clinging to roots of plants; while one variety, *S.-occidentale*, is able to live without any water for months during the summer, in dried-up ponds, under leaves and rubbish as dry as dust.

During the season just closed, I succeeded in collecting between ninety and one hundred species of mollusks, four or five of which are new to the district, and, so far as I can learn, to Canada.

Considering the discoveries made to the east and west, as well as to the south of us, having due regard to the influence of climate, I think there remain about thirty-five species of land and fresh-water shells yet to be accounted for in the vicinity of Ottawa. Of those undiscovered shells, one of the most interesting to me is *Helix nemoralis* or *hortensis*, which is known to have been seen a

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few miles to the south of this city eight years ago. It is found in the Eastern States, and along the St. Lawrence River, and is supposed to have been imported from Europe. They retain the habits of the European species, climbing hedges, trees and stems of plants, not remaining concealed under decaying leaves, logs, etc., like other American *Helices*.

To many the study of conchology is but a trifling affair—something to pass the time away—which may be very true, so far as the mere collector of shells is concerned—but to the student of nature it is a very different thing. Sowerby says, in his manual, page 157:—"Indeed all who would study geology with success, will find it very essential to obtain a thorough knowledge of conchology.

Among the reasons for the study of conchology, the following might be mentioned:—The great assistance it affords the students of geology; second, the determination with all speed of the limits of species before they are influenced by civilization; and last, though not least, is the vast amount of amusement and instruction to be obtained therefrom, or, in other words, the pleasure of having a hobby.

I hope the coming season will not pass without our Club being able to add three or four workers in this very interesting, but much neglected field of natural science.

List of Shells found about Ottawa City, 1879.

GASTEROPODA.

Pectinibranchiata.

Viviparidæ.

Paludina decisa, Say.
Valvata tricarinata, Say.
" humeralis, Say.
Amnicola porata, Say.
" granum, Say.
" lapidaria? Hald.

Melaniadæ.

Melania livescens.

Pulmonibranchiata.

Limnæidæ.

Limnæa stagnalis, Lin.
" columella, Say.
" elodes, Say.
" umbrosa, Say.
" catascopium, Say.
" caperata, Say.
" humilis, Say.
" desidiosa, Say.

Limnæidæ.—Continued.

Limnæ gracilis, Say.
" decolata, Mighells.
Physa heterostropha, Say.
Physa ancillaria, Say.
" Lordi, Baird.
" brevispira, Lea.
" hypenorum, Lin.
Planorbis trivolvis, Say.
" lentus, Say.
" campanulatus, Say.
" bicarinatus, Say.
" exacutus, Say.
" deflectus, Say.
" hirsutus, Say.
" parvus, Say.
" Billingsii? Lea.
" macrostomus, Whiteaves.
Planorbulina armigera, Say.
Ancylus rivularis, Say.

Helicidæ.

Tebennophorus Carolinensis, Bosc.
Limax campestris, Gould.
Vitrina Limpida, Gould.
Succinea obliqua, Say.
" ovalis, Say.
" avara, Say.

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LIST OF SHELLS FOUND ABOUT OTTAWA CITY, 1879.—*Continued.*

Helicidæ.—Continued.

Helix albolabris, Say.
" Sayii, Binney.
" monodon, Racket.
" alternata, Say.
" multidentata, Binney.
" lineata, Say.
" labyrinthica, Say.
" chersina, Say.
" striatella, Anthony.
" pulchella, Muller.
" concava, Say.
" electrina, Gould.
" arborea, Say.
" indentata, Say.
" inornata, Binney.
" exigua, Stimpon.
" minutissima, Lea.
" nitida, Muller.
Bulimus lubricus, Draparuand.
Pupa pentodon, Say.
Pupa contracta, Say.
" corticaria, Say.
Vertigo ovata, Say.
" Gouldii, Binney.
" simplex, Say.
Carychium exiguum, Say.

CONCHIFERA.

DYMNARIA.

Unionidæ.

Unio radiatus, Lamarck.
" cardium, Lea.
" complanatus, Solander.
" dilatatus, Rafinesque.
" olivarious.
" rectus, Lamarck.
" alatus, Say.
Margaritana costata, Rafinesque.
" marginata, Say.
" undulata, Say.
Anodon cataracta, Say.
" undulata, Say.

Cycladidæ.

Sphærium sulcatum, Lamarck.
" striatinum, Lamarck.
" rhomboideum, Say.
" occidentale, Prime.
" securis? Prime.
" partumeum? Say.
Pisidium compressum, Prime.
" Adamsii? Prime.
" abditum? Hald.
" ventricosum, Prime.

List of shells (fossil) found in marl beds near Ottawa City during the year 1879:—

Valvata tricarinata, Say.
Amnicola porata, Say.
Planorbis campanulatus, Say.
" parvus, Say.
" exacutus, Say.
" bicarinatus, Say.
Physa heterostropha, Say.
" ancillaria, Say.
Ancylus ——?
" ——?
Limnæa disidiosa.
Sphærium rhomboideum, Say.
" sulcatum.
Pisidium ventricosum?
" ——?
Unio complanatus? Say.

Since the above was written I have learned that Physa Lordi (Baird) is found in the northern parts of the State of Michigan, but was at first described as Physa Parkeri; also, that Helix nitida, Muller, is common in the same State, and that it may prove common in Western Canada.

I have also found Helix milium, Morse (April. 1880); and I find Helix minutissima, Lea, to be very common in certain localities. Both of these shells are new to the Canadian list, so far as I have been able to learn.

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SEVENTH SOIRÉE.

MONDAY, 15TH MARCH.—"ON SOME INSECTS CAPTURED DURING OUR EXCURSIONS."—MR. W. HAGUE HARRINGTON.

It affords me much pleasure to have the opportunity this evening of bringing before you a few facts concerning some of the various insects taken during our delightful excursions last summer. If the first half of my paper seems somewhat wide of the text, it is because I feared that an address devoted entirely to descriptions of insects might be uninteresting to some, and because I wished to make a few general observations on Entomology, a subject which has as yet not received, from the members of this Club, the consideration it so richly deserves. Still, recollecting that Rome was not built in a day, we must make allowance for the youth of the Club, the work accomplished by which during the year just closing—the first year of its existence—has been a highly creditable one, surpassing the most sanguine anticipations of its promoters, who now can confidently look forward to increasing fruitful labours by its members. The attention of these has been, in the present year, too exclusively occupied by one subject, in itself a very worthy one, but one which should not absorb so much of the best talent of the Club. While botany has had its score or more of devotees, the sister branches have been attended but by two or three. Thus it has been with Entomology, which has claims equal with, if not greater than, those of Botany upon our members. Perhaps it is as well that Botany has first been investigated, because some knowledge of it is necessary to the student of insect life. If one would be a thorough entomologist—and to be thorough should be the aim of all—it is indispensable that he should be able to identify the plants upon which he may find certain insects. We need only look around us at the well-filled and carefully-arranged cases upon these walls to be aware that, at one time, an entomologist of no mean abilities pursued his pleasing and useful labours in this locality; and have we not the right to expect that some among the members of this Club may be able to accomplish like results and achieve like reputation in this wide field where he (Mr. Billings) worked so successfully?

At the present time there is not much occasion to vindicate the study of any branch of Natural History from the charge of being merely the frivolous amusement of unpractical minds. Some years ago it might have been necessary to do so, for naturalists, and particularly entomologists, were looked upon as harmless lunatics and idlers. No doubt, by many of our citizens, in common with those of other places, the insect-collector is still looked upon with mingled compassion and ridicule when they chance to meet him wandering in field and wood, but as these places have few charms for such practical and hard-headed personages, he is generally free from their observations. I am sure, however, that no such feeling lurks among my fellow-members, for, having enrolled themselves among the students of Nature, they have learned that all her productions are of much interest and worthy of careful investigation. Still, those who have not paid particular attention to the subject of insect life can have but a slight idea of the important part played by these minute but innumerable creatures in the economy of nature. Their size, in general, is so insignificant, and their individual performances are so limited, that it would seem almost absurd to accuse them of the destruction actually accomplished by their joint efforts. You are all familiar with the loss inflicted on our farmers by the Colorado potato beetle;—perhaps many of you have had some difficulty in keeping him off your premises—yet this beetle, despite the potatoes and paris-green he devours, is a much less obnoxious insect than some which infest even our own country. Our prairie province, Manitoba, has in the past suffered severely from the locusts, or grasshoppers, and these have also devastated, in some years, immense tracts in the Western States, devouring wheat, corn, barley and every green thing; the loss

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caused by them in 1873 being estimated at $40,000.000. As a partial compensation it has been proposed to use the grasshoppers as food, as is the custom in the East, and, according to those who have tried them as an article of diet, there is at least no occasion for anyone to starve, even if every vestige of his crops were devoured. In the case of some equally destructive insects even this last recourse fails, for they are so small, and sometimes so unsavory, that they can serve neither for soup nor roast. Of such is the chinch bug, which, although no bigger than a grain of wheat, destroys millions of bushels of this and other grain every year. The damage wrought by them in 1864 has been estimated at $100,000,000, and a like sum was the cost of their ravages in 1874. As they are not equally abundant every season the average annual loss caused by them may be set down at $25,000,000, or considerably more than would alleviate the present distress in Ireland. In the Southern States the cotton worm—the larva of a moth called *Aletia argillacea*—causes a yearly loss of $50,000,000, representing an amount of raw material sufficient to furnish cotton to clothe our whole population for at least five years.

A still smaller insect, known as *Phylloxera*, a species of plant-louse, has, within the last few years, ruined over 700,000 acres of the fairest vineyards of France, and has almost destroyed one of the leading industries of the kingdom. You are all aware of the immense sum paid by that country as a war indemnity; well, it has been stated by a high authority that she would be cheaply rid of these American invaders at the same price paid to the Germans for vacating her territories. The failure of foreign vintages, however, to most of us, is of far less importance than the deficient yield of our grain fields. Wine is the luxury of the few; whiskey—I meant to say bread—the necessity of the many. In addition to the insects just mentioned, there are countless myriads belonging to different species which attack other plants. Our fruit and forest trees are attacked in root, trunk, branch, leaf, bud, flower and fruit. Seventy-five species infest, more or less, the apple tree, and a similar number our beautiful elm. About a hundred varieties are found upon the lofty pine and stately oak, while every kind of tree and shrub has its special enemies. In our fields, heavy tolls are levied on the various crops, and in our gardens they rob us of our green peas and asparagus, our young corn and salads, our cucumbers and tomatoes; vegetables and flowers alike suffer by their depredations. The yearly loss inflicted on agriculturists in the United States and Canada is estimated to exceed $250,000,000. When we further find these minute enemies riddling our garments, revelling in our larders, and not hesitating even to pierce and torment our bodies, we may be led to consider them unmitigated pests, present in this fair world only to plague and harm us. But we will find, on examination of the insect world, that there are numerous and extensive families of beneficial insects preying upon the obnoxious ones, and otherwise aiding man, and we will be led gradually to modify, and, finally, greatly to reverse our former opinions, as we find insects occupying a most important part in preserving the balance of nature. while man himself is chiefly responsible for many of the evils which he suffers from them. Linnæus has denominated insects "the diligent and faithful servants of nature—perpetually engaged in destroying all that is dead, and checking all that is living in the vegetable world." The evidences of this can be witnessed daily in our own magnificent forests, tenanted as they are by so many destructive and obnoxious insects; and in the tropics, where insects are vastly more numerous and of far greater size, the luxuriant vegetation teaches us that, under normal conditions, vegetable productions do not suffer to a hurtful degree by their myriad enemies. These, by removing all dead and decaying vegetation, but clear the ground more rapidly for new growths, while, by devouring seeds and young plants, and by assisting in the destruction of matured ones, they prevent the more rapidly-growing species from crowding out the slower. A certain equilibrium is thus maintained until disturbed by the agency of man.

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As soon, however, as immense tracts of land are cleared of their natural growth and sown with those plants so widely cultivated for man's sustenance, the insects, deprived of their proper food plants, are in many cases found transferring themselves to the new quarters provided. The natural enemies also of a plant will, as that plant is more and more widely sown, be placed in a more favourable position to live and multiply, and often will increase so enormously in number as to be a source of much dread to the agriculturist. If the farmer, glancing proudly across his spreading fields of wheat, presently sees, hovering over them, clouds of minute insects, dancing in the sunlight, and finds these to be innumerable swarms of chinch bugs, hessian flies or similar foes, he must not consider it a special affliction of Providence, but the natural working of laws that have existed for untold periods. Man, as he has spread from continent to continent, clearing and cultivating and subduing the earth, has carried with him not only his various animals, grains, flowers, fruits and vegetables, but has continually borne along, or been steadily followed by, many of his natural insect foes. Long lists could be given of insects which have been introduced into this country from Europe. One instance may be noticed, because the insect was brought but recently into Canada, and is known to all of you—I refer to *Pieris rapæ*, the cabbage butterfly. This, the common white butterfly—of which numbers were seen at several of our excursions—is easily distinguished from our native white by the black spots on its wings and the yellowish tint of the under-surface. It is about twenty years since it was first brought to Quebec—probably in the egg state on cabbage leaves—and its descendants have since destroyed millions of cabbages. The first one was captured in Quebec in 1859; ten years later it had occupied a large portion of the Middle States; in 1875 it reached the western part of this province; two years ago I found it common in the most eastern portion of Nova Scotia, and its range is steadily widening west and south; last year it was reported common in Alabama and beyond Ohio, and wherever cabbages can grow this lover of them may be expected to find its way. It is impossible to estimate the extent of the loss inflicted by them, but, in one year, they destroyed, in the neighbourhood of Quebec, over 250,000 head of cabbage. Those of you who cultivate this vegetable in your gardens must have observed that, of late, these butterflies have not been so numerous as in former years, and you may have wondered why it should be so; well, it is to the efforts of a very small ichneumon fly, called *Pteromalus puparum*, that the diminution in their numbers is due. This little fly, the natural foe of the butterfly, has, in some unknown way, followed it here from Europe, and has since multiplied so greatly as to be a powerful check upon the increase of the butterflies. The female ichneumon deposits her eggs in the chrysalis, which, if opened some time afterward, will be found occupied by some fifty small grubs; and at least half the chrysalids examined will be found in this condition.

In contemplating the loss and annoyance caused by insects, people too readily overlook the benefits derived from them—benefits so numerous that I shall mention only the chief one. They are the scavengers of nature, removing quietly and quickly all decaying animal and vegetable matter, and thus purifying both the air and the water. I will not weary you by entering further this evening into the great and varied claims that Entomology, as a study, has upon us, whether we consider the beauty or the grotesqueness of colour or ornamentation of some species; the social instincts and surprising intelligence of such as bees and ants; the curious and often complex habitations of many; the metamorphoses undergone; the products with which they furnish us; the wonderful instruments, such as stings, which they possess; or a multitude of equally important points, we find scope for the exercise of the highest powers of the intellect, and material can be gathered near at hand to give employment throughout a lifetime, and I trust that some among my hearers may be tempted to look more carefully and fully into the strange and admirable phases of insect life, by

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which they are surrounded, than they have in the past, and favour us next winter with the results of their observations. A recent writer in one of our periodicals asserts that "the happiness of life depends far more on the choice that young people make of a recreation than it does on their profession or employment—choose your pastime out of doors; make yourself Nature's playmate." This may seem at first the somewhat strong expression of an enthusiastic lover of out-door life, but on consideration it appears not unworthy of cordial acceptance. Work must be interspersed by recreation to make life really enjoyable, and to those whose work keeps them much shut up, the advice to choose an out-door pastime is indeed good. The very existence of this Club testifies that its members at least are followers of such advice.

The first and most notable insects taken on the 22nd May, the day of the excursion to King's Mere, were a pair of fine luna moths, *Attacus luna*. This species is one of a group in which our largest and handsomest moths are contained, and is, in the estimation of many, the most beautiful of all our lepidoptera. The body of the moth, as you will observe on inspection, is snowy white, while the wings are of a delicate pale green, with a transparent eye-spot in each. The hinder wings are prolonged so as to form tails an inch and a half in length. The caterpillars feed upon walnut and hickory, and may be found full grown about the end of July on the butternut trees in this vicinity. They are then from two to three inches long, and are pale green with a yellow stripe on each side, in addition to other slight markings. Their strong, oval, white cocoons are spun in the leaves, with which they fall to the ground in autumn. The moths emerge in early spring, and fly, as do the majority of such insects, at night; hence they are rarely seen except in collections. At the time of the first excursion it was too early in the season for most of the butterflies, and many other insects, to be abroad, but a good many varieties of beetles were to be had. Among these were several species of weevils, including *Balininus nasicus*, the nut-weevil, which destroys so many hazel-nuts, and which was unusually abundant last summer. This beetle derives its name from its very long and slender rostrum or snout, which is longer than its body, although no thicker than a stout bristle. Its oval or somewhat pear-shaped body is clothed with short yellowish hair. Three or four other species were taken upon pines, which they greatly damage by destroying the terminal shoots, and thus checking the growth of the tree and stunting it. One of these, *Pissodes affinis*, is shown on the upper left corner of this chart upon the wall, with its larva, which is a stout, footless grub. The family of the Curculionidæ, or weevils, is very extensive, numbering several thousand named species. Its members are readily distinguished by the long snout and elbowed antennæ; the majority are small, and many are very minute insects. The life history of the greater number remains to be investigated, but their young live generally in seeds, fruits, etc., and are of course destructive to vegetation. The plum, pea and grain weevils are known to all farmers by their ravages. A very pretty species taken at King's Mere was *Polydrosus elegans*. This beetle is usually of a greyish buff, but the color varies considerably, and some of the males found by me are of a beautiful green. *Corymbites triundulatus* and *hieroglyphicus* with a few other elaters, were taken on pines and on some trees, such as cherry, which were in blossom. The upper figure on the right represents a member of this family, which are commonly known as spring-beetles, because they have the power when placed upon their backs of throwing themselves some distance into the air, in which they turn so as to alight upon their feet again. The larvæ of some species live under bark, or in old trees or decaying wood, and are harmless, but those of other species burrow in the soil, and destroy much vegetation by cutting off young plants at the surface, and by gnawing roots, etc. The species intended to be shown is a somewhat common one, *Agriotes mancus*, the larva of which does much injury to young wheat. In early spring, immense numbers of small cylindrical beetles are often observed, which, from their shape, appear as if

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they had been made by the inch and then cut into ten, fifteen or more pieces. They live under the bark of various trees, and *Hylastes pinifex* and others were taken at King's Mountain. On the occasion of our trip to meet the Montreal Natural History Society at Calumet, the season was more favourable to an abundance of insect life, and many species were observed, including some of our largest butterflies. Unfortunately, the only member who collected butterflies on this excursion (Mr. Greata) has since left the city, so that I do not know exactly what ones were taken. Among them, however, was *Danais archippus*, which is a very large butterfly with tawny orange wings, margined and veined with black, and bordered with a double row of white spots. The caterpillar, when full grown, is about two inches long, and is banded with alternate transverse stripes of yellow, black and white. It has also a pair of thread-like black horns at each end, and may be found feeding in June and July upon the common milk-weed. Another large and handsome butterfly seen was *Papilio turnus*, the yellow swallow-tail, the caterpillar of which feeds upon apple, wild cherry, etc., and is of a light green color, with rows of blue spots along the back, and a curious eye-spot, yellow with a black centre, on each side of the third segment. The caterpillars of this and of *Papilio asterias*—the black swallow-tail—when touched, thrust out through a slit just behind the head, a curious forked scent-organ, which emits a disagreable smell, apparently with the object of driving away insect foes. *Colias philodice*, the bright yellow butterfly, was abundant. Its larva feeds upon clover, which valuable plant, by the way, is known to be relished by over fifty species of insects. A fine species of tiger-beetle, *Cicindela longalabris*, which I have never observed elsewhere, was taken, apparently searching for ants, in the open spot in which we all lunched. Tiger-beetles have received their name from their swiftness and fierceness in seizing the insects upon which they live. The larvæ live in sandy or light soils, in perpendicular holes, at the top of which they lie in wait for passing insects. Three species of these beetles are common, viz.: *Vulgaris*, the common, *Hirticollis*, the hairy-necked, and *Sex-guttata*, the six-spotted. The two first are to be found upon roads, or sandy places; they fly swiftly a short distance when alarmed, and also run quickly about. *Cicindela sex-guttata* is more frequently found sunning itself on fences and stones. It is of a lustrous green, with six, or frequently eight yellow spots on the wing-covers. Another fine tiger-beetle, *C. purpurea*, is found in fields among the grass, and is more difficult to capture. A beetle taken at Calumet in some numbers was *Saperda vestita*, the clothed or coated saperda, so named from its covering of short, yellowish hair. Its length is about three-fourths of an inch, and the larva, figured with the beetle, in centre of upper row, does much damage sometimes to lindens. An allied species, *Saperda tridentata*, the "three-toothed Saperda," was also taken; its larva is an elm-tree borer. A third species *Saperda candida*, a brownish beetle with two longitudinal white stripes, is also found around here, and is known as the apple-tree borer, on account of its damages to that tree. Two more long-horned timber beetles were taken on young basswood trees, viz.: *Clytus ruricola*, a black beetle with yellow markings, and *Clytus erythrocephalus*, a delicate and rare beetle, of a brownish colour, with three yellow bands. The five beetles just named are among the fifty species of Cerambycidæ which I have painted, and are as nearly as possible correct in size, markings and coloring. All these fifty were taken in this immediate vicinity, and, in addition, I have some twenty others. Owing to the extent and diversity of the surrounding woods, Ottawa is very favourably situated for the collection and study of wood-eating insects, of which there are many belonging to different orders. Two species of Buprestians were also taken at Calumet, viz.: *Dicerca divaricata* and *Brachys terminans*. The larva of the first bores in beech and cherry, etc.; that of the second mines in the leaves of the basswood; that is, it lives between the upper and lower surfaces of the leaf, and devours the soft tissues. The white blotches so frequently seen in different kinds of leaves are thus formed by mining larvæ. The Buprestians are remarkable for the solidity.

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hardness and metallic brilliancy of their bodies and legs. The great majority of the species found in Canada can be obtained in this vicinity. About thirty were taken by Mr. Fletcher and myself during the past season, including one at least new to the Canadian list, viz.: *Chrysobothris Harrisii*, a beetle of a brilliant green, found on pine saplings. It is slightly smaller than the species figured in the lower left corner, which is *C. femorata*. This beetle formerly inhabited oak trees, but has now transferred itself to apple trees, which it greatly damages. The larva is very similar in form to those of the other Buprestians, and it is easy to distinguish the holes bored by them, as they are oval instead of round.

Our excursion to the Mer Bleu was, I regret to say, productive of few insects. For my own part, I was feeling quite unwell, and far from able to make any search for them. Our botanists added largely to their lists, and where new plants are found, new insects may be expected. We know, for instance, that there are some peculiar to the pitcher-plant. The pools and ditches filled by water from the mineral springs would appear favourable to the production of rare aquatic forms. Fluttering over the surface of the barren were great numbers of small butterflies, but as no specimens were captured, I cannot state confidently to what species they belonged, or if there was more than one variety. Other butterflies were seen along the route and at the Springs, including *Limenitis arthemis*, or the White Admiral. This is a very handsome butterfly, easily recognized by the broad, white band across its rich dark wings. Its flight, as it sails about through the trees along the border of an open space in the woods, is most graceful, and as it alights but for very brief intervals, its capture is often attended with some difficulty. Some years it is comparatively abundant, but last season, in common with many other butterflies, it was quite rare.

On our Saturday afternoon trip to Britannia, I observed few specimens new or worthy of description. *Epicauta cinerea*, the ash-grey blister beetle, often occurs in great numbers on wild plants, also on potatoes, and quickly strips them of their leaves. This beetle belongs to the *Cantharides*, or blister-beetles, so named from the effect produced by applying their powdered bodies to the skin. Several species occur in Canada; the one shown, lower centre figure, is *Meloe Augusticollis*, a dark-bluish insect known as the Oil Beetle. The larva of this beetle is worthy of much attention, both on account of the number of its metamorphoses, and of its peculiar and varied life. It emerges from the egg as a sprightly little six-footed creature, resembling certain forms known as spring-tails. Able to go without food for several days, it climbs upon some plant near by and lays in wait until a bee alights alongside it. When this happens, it transfers itself to the body of the bee, and holding on to the hairs with its little claws, is thus safely transported to the nest, where it fastens upon the nearest bee-grub, feeding upon it, and gradually changing to the footless form shown below. Other changes are undergone before it becomes a beetle, and even then it appears but little like one. I have not found it here, but my friend, Mr. Heron, has given me specimens taken up the Gatineau.

Owing to the late date on which the last excursion—the one to Meech's Lake—was held, few insects were met with. The spring and early summer months are those in which insects are most abundant and in which the collector makes his richest haul. After that they are, of course, always to be found, but it is more necessary to know where to look for them, and more careful and systematic searching is required to find them, so that at an excursion where much ground has to be traversed, and where sight-seeing, etc., occupy much of one's time, it cannot be expected that very many captures will be made. Concealed by a large toad-stool, and feasting upon its substance, I found a number of the curious little beetles called *Onthophagus hecate*. It is not an uncommon beetle, for it abounds wherever there is decaying animal matter, but owes its interest to the odd appearance of the male, which is easily distinguished by the upper part of the thorax projecting like a horn over the head, the front of which is also

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ornamented by an upright horn. Several species of small beetles were also taken in or under fungus upon decaying wood, where many varieties can always be obtained. One *Phellidius cornutus* has the thorax of the male produced in two long flat horns. Another, *Cratoparis lunatus* is a weevil. Among these fungi-eaters, and, probably, preying upon them, was a black beetle, a species of *carabidæ*, the members of which family live chiefly—both as larvæ and in the perfect state—upon other insects. The large diagram shows one found under stones during the daytime. It is enlarged about twenty diameters in order to show the mouth-parts, etc., common to nearly all beetles.

Spring, with its revivifying influences, is again near at hand, and with the first warm days, insects will make their appearance in rapidly-increasing numbers. Now, then, is the time to prepare the few simple articles constituting the collector's outfit, so as to be ready to take advantage of the first opportunity to go out into the fields and woods, and, note-book in hand, observe and record the doings of their lesser inhabitants.

On the same evening an instructive paper on "Some plants collected during our Excursions" was read by Mr. Fletcher, who also handed in the annexed list of plants collected by the Ottawa Field-Naturalists' Club during the season, to be held as a record by the Club. This list is arranged after the plan of Professor Macoun's catalogue, but does not include the *Musci* and *Hepaticæ;* these will be published next year.

The structure and growth of a few of the most interesting were explained, the first considered being *Clematis verticillaris*, or the large mauve-flowered woodbine. The chief part of the paper, however, was devoted to Insectivorous plants, in connection with which subject detailed descriptions were given of "the Pitcher Plant," *Sarracenia purpurea*, and the two Sundews, *Drosera rotundifolia* and *Drosera longifolia*. It was pointed out that, although these two species take their names from the shape of their leaves, they often approach each other so closely that the only sure mode of identifying them is by a microscopical examination of the seeds. A curious method of reproduction in *Nasturtium lacustre* was explained; this plant is aquatic in its habits, and, as is frequently the case with such plants, has the submerged leaves very much laciniated or cut up. These leaves become detached from the plant very early in the summer, before it has done flowering, leaving the stem naked and bare. Why these leaves should drop so early is a matter of surprise, until it is explained that when each one drops into the water it does not decay, but floats about on the surface, while at its base is gradually developed a young plantlet, which takes root and remains stationary as soon as a suitable spot is reached. Mention was also made of certain marine plants found about Ottawa, such as *Rumex maritimus*, *Triglochin maritimum*, var. *elatum*, etc., etc., pointing to the fact, which is sustained by geological investigation, that the ocean once extended to this now far inland spot.

At the conclusion of this paper, Mr. Fletcher introduced to the meeting Professor Macoun, of Belleville, a corresponding member of the Club. This gentleman made a vigorous speech, setting forth the claims of Natural Science as a means of training both mind and body to greater and more prolonged activity than can be attained by any other course of study. The Professor opposed the idea that any plants were insectivorous, in which he was supported by Dr. Kemp. There was a prolonged discussion on the subject. Mr. Fletcher defended his previously expressed belief in the insectivorous proclivities of those plants named by him, and gave an account of his own experiments and cited some of those of Professor Darwin in England.

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FLORA OTTAWAENSIS.

BY

JAMES FLETCHER.

RANUNCULACEÆ.

Clematis
verticillaris, DC.
Virginiana, L.

Anemone
cylindrica, Gray.
multifida, DC.
Pennsylvanica, L.
Virginiana, L.

Hepatica
acutiloba, DC.
triloba, Chaix.

Thalictrum
Cornuti, L.
dioicum, L.

Ranunculus
abortivus, L.
acris, L.
aquatilis, L. *v.* trichophyllus, Chaix.
Flammula, L. *v.* reptans, Meyer.
multifidus, Pursh.
Pennsylvanicus L.
recurvatus, Poir.
repens, L.

Caltha
palustris, L.

Coptis
trifolia, Salisb.

Aquilegia
Canadensis, L.

Actæa
alba, Bigel.
spicata, L. *v.* rubra, Mx.
——————(white berried form)

MENISPERMACEÆ.

Menispermum
Canadense, L.

BERBERIDACEÆ.

Berberis
vulgaris, L.

Caulophyllum
thalictroides, Michx.

NYMPHÆACEÆ.

Brasenia
peltata, Pursh.

Nymphæa
odorata, Ait.

Nuphar
advena, Ait.
pumilum, Smith.

SARRACENIACEÆ.

Sarracenia
purpurea, L.

FUMARIACEÆ.

Corydalis
aurea, Willd.
glauca, Pursh.

Adlumia
cirrhosa, Raf.

Dicentra
Canadensis, DC.
Cucullaria, DC.

PAPAVERACEÆ.

Sanguinaria
Canadensis, L.

Papaver
Rhæas, L.
somniferum, L.

Chelidonium
majus, L.

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CRUCIFERÆ.

Nasturtium
Armoracia, Fries.
lacustre, Gray.
officinale, R. Br.
palustre, DC.
———*v.* hispidum, Fisch. and Meyer.

Cardamine
hirsuta, L.
———*v.* sylvatica, Gray.
rhomboidea, D.C.
pratensis, L.

Dentaria
diphylla, L.
laciniata, Muhl.

Arabis
Drummondii, Gray.
hirsuta, Scop.
lævigata DC.
perfoliata, Lam.

Barbaræa
vulgaris, R. Br.

Erysimum
cheiranthoides, L.

Sisymbrium
officinale, Scop.

Brassica
alba, Gray.
campestris, L.
nigra, Gray.
Sinapistrum, Boiss.

Camelina
sativa, Crantz.

Capsella
Bursa-pastoris, Mœnch.

Thlaspi
arvense, L.

Lepidium
Virginicum, L.

VIOLACEÆ.

Viola
blanda, Willd.
Canadensis, L.
canina, L. *v.* sylvestris Reg.
cucullata, Ait.
pubescens, Ait.
renifolia, Gray.
rostrata, Pursh.

DROSERACEÆ.

Drosera
longifolia, Mx.
rotundifolia, L.

HYPERICACEÆ.

Hypericum
Canadense. L.
corymbosum, Muhl.
ellipticum, Hooker.
mutilum, L.
perforatum, L.

Elodes
Virginica, Nutt.

CARYOPHYLLACEÆ.

Silene
antirrhina, L.
Armeria, L.
inflata, Smith.
noctiflora, L.

Saponaria
officinalis, L.
vaccaria, L.

Lychnis
Githago, Lam.

Arenaria
lateriflora, L.
Michauxii, Hook.
serpyllifolia, L.

Stellaria
borealis, Bigel.
longifolia, Muhl.
media, Smith.

Cerastium
nutans, Raf.
viscosum, L.

PORTULACACEÆ.

Portulaca
oleracea, L.

Claytonia
Caroliniana, Michx.

MALVACEÆ.

Malva
crispa, Gray.
moschata, L.
rotundifolia, L.
sylvestris, L.

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Abutilon
Avicennæ, Gærtn.

Hibiscus
Trionum, L.

TILIACEÆ.

Tilia
Americana, L.

LINACEÆ.

Linum
usitatissimum, L.

GERANIACEÆ.

Geranium
Carolinianum, L.
Robertianum, L.

Erodium
cicutarium, L'Her.

Impatiens
fulva, Nutt.

Oxalis
Acetosella, L.
corniculata, L. *v.* stricta, Hook.

RUTACEÆ.

Zanthoxylum
Americanum, Mill.

ANACARDIACEÆ.

Rhus
Toxicodendron, L.
typhina, L.

VITACEÆ.

Vitis
cordifolia, Mx.

Ampelopsis
quinquefolia, Mx.

RHAMNACEÆ.

Rhamnus
alnifolia, L'Her.

Ceanothus
Americanus, L.

CELASTRACEÆ.

Celastrus
scandens, L.

SAPINDACEÆ.

Acer.
dasycarpum, Ehrh.
Pennsylvanicum, L.
rubrum, L.
saccharinum, L.
————*v.* nigrum, T. and G.
spicatum, Lam.

Negundo
aceroides, Mœnch.

Staphylea
trifolia, L.

POLYGALACEÆ.

Polygala
Senega, L.

LEGUMINOSÆ.

Trifolium.
agrarium, L.
arvense, L.
hybridum, L.
pratense, L.
procumbens, L.
repens, L.

Meliotus
alba, Lam.
officinalis, Willd.

Medicago
lupulina, L.

Astragalus
Canadensis, L.

Desmodium
acuminatum, DC.
Canadense, DC.
cuspidatum, T. and Gr.

Vicia
Cracca, L.
hirsuta, Koch.
sativa, L.
tetrasperma, Mœnch.

Lathyrus
ochroleucus, Hook.
palustris, L.
————*v.* myrtifolius, G.

Apios
tuberosa, Mœnch.

Amphicarpæa
monoica, Nutt.

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ROSACEÆ.

Prunus
Americana, Marsh.
Pennsylvanica, L.
serotina, Ehrh.
Virginiana, L.

Spiræa
opulifolia, L.
salicifolia, L.
tomentosa, L.

Agrimonia
Eupatoria, L.

Geum
album, Gmelin.
strictum, Ait.

Waldsteinia
fragarioides, Tratt.

Fragraria
vesca, L.
Virginiana, Ehrh.

Potentilla
Anserina, L.
argentea, L.
arguta, Pursh.
Norvegica, L.
palustris, Scop.

Rubus
Canadensis, L.
Dalibarda. L.
hispidus, L.
occidentalis, L.
odoratus, L.
strigosus, Mx.
triflorus, Rich.
villosus, Ait.
———*v.* frondosus, Tor.
———*v.* humifusus, T. and G.

Rosa
blanda, Ait.
lucida, Ehrh.

Cratægus
coccinea, L
tomentosa, L.

Pyrus
Americana, DC.
arbutifolia, L. *v.* erythrocarpa, Gray.
———*v.* melanocarpa, Hook.
sambucifolia, Ch. and Sc.

Amelanchier
alnifolia, Watson.
Canadensis, T. and G.
———*v.* (?) oblongifolia, T. & G.

SAXIFRAGACEÆ.

Ribes
Cynosbati, L.
floridum, L'Her.
lacustre, Poir.
oxacanthoides, L.
prostratum, L'Her.
rubrum, L.

Saxifraga
Virginiensis, Mx.

Mitella
diphylla, L.
nuda, L.

Tiarella
cordifolia, L.

Chrysosplenium
Americanum, Schw.

CRASSULACEÆ.

Sedum.
acre, L.

Penthorum
sedoides, L.

HALORAGEÆ.

Hippuris
vulgaris, L.

Myriophyllum
spicatum, L.

ONAGRACEÆ.

Circæa
alpina, L.
Lutetiana, L.

Epilobium
angustifolium, L.
coloratum, Muhl.
molle, Torr.
palustre, L. *v.* lineare, Gray.

Œnothera
biennis, L.
———*v.* grandiflora, Lindl.
———*v.* muricata, Lindl.
pumila, L.

Ludwigia
palustris, Ell.

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LYTHRACEÆ.

Nesæa
verticillata, H. B. K.

CUCURBITACEÆ.

Echinocystis
lobata, T. and G.

UMBELLIFERÆ.

Sanicula
Canadensis, L.
Marilandica, L.

Hydrocotyle
Americana, L.

Daucus
Carota, L.

Pastinaca
sativa, L.

Cicuta
bulbifera, L.
maculata, L.

Sium
cicutæfolium, Gmelin.

Cryptotænia
Canadensis, DC.

Osmorrhiza
brevistylis, DC.
longistylis, DC.

Conium
maculatum, L.

Carum
Carui, L.

ARALIACEÆ.

Aralia
hispida, Mx.
nudicaulis, L.
quinquefolia, Gray.
racemosa, L.
trifolia, Gray.

CORNACEÆ.

Cornus
alternifolia, L.
Canadensis, L.
circinata, L'Her.
sericea, L.
stolonifera, Michx.

CAPRIFOLIACEÆ.

Linnæa
borealis, Gronov.

Symphoricarpus
racemosus, Mx. *v.* pauciflorus, Robbins.

Lonicera
ciliata, Muhl.
hirsuta, Eaton.
parviflora, Lam.

Diervilla
trifida, Mœnch.

Sambucus
Canadensis, L.
pubens, Mx.

Viburnum
acerifolium, L.
lantanoides, Michx.
Lentago, L.
nudum, L. *v.* cassinoides, G.
Opulus, L.
pubescens, Pursh.

Triosteum
perfoliatum, L.

RUBIACEÆ.

Galium
Aparine, L.
asprellum, Michx.
circæzans, Michx.
lanceolatum, Michx.
trifidum, L.
triflorum, Mx.
verum, L.

Cephalanthus
occidentalis, L.

Mitchella
repens, L.

COMPOSITÆ.

Eupatorium
ageratoides, L.
perfoliatum, L.
purpureum, L.

Aster
acuminatus, Michx.
cordifolius, L.
corymbosus, Ait.
longifolius, Lam.
Novæ-Angliæ, L.
macrophyllus, L.

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miser, L.
puniceus, L.
simplex, Willd.
tenuifolius, L.

Erigeron
annuum, pers.
Canadense, L.
Philadelphicum, L.
strigosum, L.

Diplopappus
umbellatus, T. and G.

Solidago
arguta, Ait.
——— *v.* scabrella, Gray.
bicolor, L.
——— *v.* concolor, G.
cæsia, L.
Canadensis, L.
gigantea, Ait.
latifolia, L.
lanceolata, Ait.
nemoralis, Ait.
squarrosa, Muhl.

Inula
Helenium, L.

Ambrosia
artemisiæfolia, L.

Xanthium
strumarium, L.

Rudbeckia
hirta, L.

Bidens
Beckii, Torr.
cernua, L.
chrysanthemoides, Mx.
connata, Muhl.
frondosa, L.

Maruta
Cotula, DC.

Achillæa
Millefolium, L.

Leucanthemum
vulgare, Lam.

Tanacetum
vulgare, L.

Artemisia
Absinthium, L.
biennis, Willd.
vulgaris, L.

Gnaphalium
decurrens, Ives.
uliginosum, L.
polycephalum, Mx.

Antennaria
margaritacea, R. Br.
plantaginifolia, R. Br.

Senecio
aureus, L.

Erechthites
hieracifolia, Raf.

Circium
arvense, Scop.
lanceolatum, Scop.

Lappa
officinalis, All.

Lampsana
communis, L.

Cichorium
Intybus, L.

Hieracium
Canadense, Mx.
scabrum, Michx.

Nabalus
albus, Hook.
altissimus, Hook.

Tragopogon
pratensis, L.
porrifolius, L.

Taraxacum
Dens-leonis, Desf.

Sonchus
arvensis, L.
asper, Vill.
oleraceus, L.

Lactuca
Canadensis, L.
——— *v.* sanguinea, Gray.

LOBELIACEÆ.

Lobelia
cardinalis, L.
inflata, L.

CAMPANULACEÆ.

Campanula
aparinoides, Pursh.
rotundifolia, L.

ERICACEÆ.

Gaylussacia
resinosa, T. and G.

Vaccinium
Canadense, Kalm.
corymbosum, L.
macrocarpon, Ait.

Digitized by Google

Oxycoccus, L.
Pennsylvanicum, L.
vacillans, Solander.

Chiogenes
hispidula, T. and G.

Arctostaphylos
Uva-ursi, Spreng.

Epigæa
repens, L.

Gaultheria
procumbens, L.

Cassandra
calyculata, Don.

Andromeda
polifolia, L.

Kalmia
angustifolia, L.
glauca, Ait.

Ledum
latifolium, Ait.

Pyrola
chlorantha, Swartz.
elliptica, Nutt.
rotundifolia, L.
————*v.* asarifolia, G.
————*v.* incarnata, G.
secunda, L.

Pterospora
Andromedea, Nutt.

Moneses
uniflora, Gray.

Chimaphila
umbellata, Nutt.

Monotropa
uniflora, L.

AQUIFOLIACEÆ.

Ilex
verticillata, Gray.

Nemopanthes
Canadensis, DC.

PLANTAGINACEÆ.

Plantago
lanceolata, L.
major, L.

PRIMULACEÆ.

Trientalis
Americana, Pursh.

Lysimachia
ciliata, L.
stricta, Ait.
thyrsiflora, L.

Anagallis
arvensis, L.

Samolus
Valerandi, L. *v.* Americanus, Gr.

LENTIBULACEÆ.

Utricularia
cornuta, Michx.
intermedia, Hayne.
vulgaris, L. *v.* Americana, Gray.

OROBANCHACEÆ.

Epiphegus
Virginiana, Bart.

SCROPHULARIACEÆ.

Verbascum
Blattaria, L.
Thapsus, L.

Scrophularia
nodosa, L.

Chelone
glabra, L.

Pentstemon
pubescens, Solander.

Mimulus
ringens, L.

Gratiola
aurea, Muhl.
Virginiana, L.

Ilysanthes
gratioloides, Benth.

Veronica
agrestis, L.
Anagallis, L.
Americana, Schw.
arvensis, L.
officinalis, L.
peregrina, L.
scutellata, L.
serpyllifolia, L.

Gerardia
purpurea, L. *v.* paupercula, G.

Pedicularis
Canadensis, L.

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VERBENACEÆ.

Verbena
hastata, L.
urticifolia, L.

Phryma
Leptostachya, L.

LABIATÆ.

Teucrium.
Canadense, L.

Mentha
Canadensis, L.
piperita, L.

Lycopus
sinuatus, Gray.
Virginicus, L.

Hyssopus
officinalis, L.
————(white flowered variety)

Calamintha
Clinopodium, Benth.
Nepeta, Link.

Hedeoma
pulegioides, Pers.

Nepeta
Cataria, L.
Glechoma, Benth.

Dracocephalum
parviflorum, Nutt.

Brunella
vulgaris, L.

Scutellaria
galericulata, L.
lateriflora, L.
parvula, Mx.

Galeopsis
Tetrahit, L.

Leonurus
Cardiaca, L.

Stachys
palustris, L.
————*v.* aspera, Gray.
————*v.* cordata, Gray.

Lamium
amplexicaule, L.

BORRAGINACEÆ.

Echium
vulgare, L.

Symphytum
officinale, L.

Lithospermum
arvense, L.
officinale, L.

Asperugo
procumbens, L.

Echinospermum
Lappula, Lehm.

Cynoglossum
Morisoni, DC.
officinale, L.
Virginicum, L.

Lycopsis
arvensis, L.

CONVOLVULACEÆ.

Calystegia
sepium, R. Br.
spithamæa, Pursh.

Cuscuta
Gronovii, Willd.

Convolvulus
arvensis, L.

SOLANACEÆ.

Solanum
Dulcamara, L.
nigrum, L.
rostratum, Dunal.

Physalis
grandiflora, Hook.
Peruviana.

Hyoscyamus
niger, L.

Datura
Stramonium, L.

Nicotiana
rustica, L.

GENTIANACEÆ.

Gentiana
Andrewsii, Griesb

Menyanthes
trifoliata, L.

APOCYNACEÆ.

Apocynum
androsæmifolium, L
cannabinum, L.

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ASCLEPIADACEÆ.

Asclepias
Cornuti, Decaisne.
incarnata, L.

OLEACEÆ.

Fraxinus
Americana, L
pubescens, Lam.
sambucifolia, Lam.

ARISTOLOCHIACEÆ.

Asarum
Canadense, L.

CHENOPODIACEÆ.

Chenopodium
album, L.
Botrys, L.
glaucum, L.
hybridum, L.
urbicum, L.

Blitum
Bonus-Henricus, Reich.
capitatum, L.

Atriplex
patula, L.

AMARANTACEÆ.

Amarantus
albus, L.
retroflexus, L.

POLYGONACEÆ.

Polygonum
acre, H. B. K.
amphibium, L. *v.* aquaticum.
————*v.* terrestre.
arifolium, L.
aviculare, L.
————*v.* erectum, Roth.
cilinode, Mx.
Convolvulus, L.
dumetorum, L'Her.
————*v.* scandens, Gray.
Hydropiper, L.
hydropiperoides, Mx.
orientale, L.
Pennsylvanicum, L.
Persicaria, L.
sagittatum, L.

Rumex
Acetosella, L.
crispus, L.
maritimus, L.
obtusifolius, L.
orbiculatus, Gray.
verticillatus, L.

Fagopyrum
esculentum, Mœnch.

THYMELEACEÆ.

Dirca
palustris, L.

ELÆAGNACEÆ.

Shepherdia
Canadensis, Nutt.

SANTALACEÆ.

Comandra
umbellata Nutt.

CERATOPHYLLACEÆ.

Ceratophyllum
demersum, L.

CALLITRICHACEÆ.

Callitriche
verna, L.

EUPHORBIACEÆ.

Euphorbia
Cyparissias, L.
Helioscopia, L.
maculata, L.

Acalypha
Virginica, L.

URTICACEÆ.

Ulmus
Americana, L.
fulva, Michx.
racemosa, Thomas.

Urtica
gracilis, Ait.

Laportea
Canadensis, Gaud.

Humulus
Lupulus, L.

Pilea
pumila, Gray.

Bœhmeria
cylindrica, Willd.

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Cannabis
sativa, L.

JUGLANDACEÆ.

Juglans
cinerea, L.

Carya
amara, Nutt.

CUPULIFERÆ.

Quercus
alba, L.
macrocarpa, Michx.
rubra, L.

Fagus
ferruginea, Ait.

Corylus
rostratra, Ait.

Ostrya
Virginica, Willd.

Carpinus
Americana, Michx.

MYRICACEÆ.

Myrica
Gale, L.

Comptonia
asplenifolia, Ait.

BETULACEÆ.

Betula
papyracea, Ait.
lutea, Michx. f.

Alnus
incana, Willd.

SALICACEÆ.

Salix
candida, Willd.
cordata, Muhl.
———*v.* angustata, Pursh.
discolor, Muhl.
fragilis, L.
humilis, Marshall.
livida, Wahl. *v.* occidentalis, Gray.
lucida, Muhl.
nigra, Marshall.
petiolaris, Smith.

Populus
alba, L.
balsamifera, L.
dilatata, Ait.
grandidentata, Michx.
tremuloides, Michx.

CONIFERÆ.

Pinus
Banksiana, Lamb.
resinosa, Ait.
Strobus, L.

Abies
alba, Mx.
balsamea, Marsh.
Canadensis, Michx.
nigra, Poir.

Larix
Americana, Mx.

Thuja
occidentalis, L.

Taxus
baccata, L. *v.* Canadensis, Gray.

Juniperus
communis, L.
Virginiana, L.

ARACEÆ.

Acorus
Calamus, L.

Calla
palustris, L.

Arisæma
triphyllum, Torr.

LEMNACEÆ.

Lemna
minor, L.
polyrrhiza, L.
trisulca, L.

TYPHACEÆ.

Sparganium
eurycarpum, Engelm.
simplex, Huds.

Typha
angustifolia, L.
latifolia, L.

NAIADACEÆ.

Naias
flexilis, Rostk.

Zanichellia
palustris, L.

Potamogeton
Claytonii, Tuck.
compressus, L.
gramineus, L. *v.* heterophyllus, Fries.
natans, L.
pectinatus, L.

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perfoliatus, L.
pusillus, L.
Spirillus, Tuck.

ALISMACEÆ.

Alisma
Plantago, L. *v.* Americanum, Gr.

Triglochin
maritimum, L. *v.* elatum, G.

Sagittaria
variabilis, Engelm.
heterophylla, Pursh.

HYDROCHARIDACEÆ.

Anacharis
Canadensis, Planch.

Vallisneria
spiralis, L.

ORCHIDACEÆ.

Orchis
spectabilis, L.

Habenaria
blephariglottis, Hook.
dilatata, Gray.
Hookeri, Torr.
———*v.* oblongifolia, G.
hyperborea, Lindl.
orbiculata, Torr.
psychodes, Gray.
rotundifolia, Rich.
tridentata, Hook.
viridis, R. Br. *v.* bracteata, Reich.

Goodyera
repens, R. Br.

Spiranthes
cernua, Richard.

Calopogon
pulchellus, R. Br.

Calypso
borealis, Salisb

Pogonia
ophioglossoides, Nutt.

Microstylis
monophyllus, Lindl.
ophioglossoides, Nutt.

Liparis
Loselii, Rich.
———? (large form with 24 flowers and leaves 9 inches long)

Corallorhiza
innata, R. Br.
multiflora, Nutt.

Cypripedium
acaule, Ait.
parviflorum, Salisb.
pubescens, Willd.
spectabile, Swartz.

IRIDACEÆ.

Iris
versicolor, L.

Sisyrinchium
Bermudiana, L.

SMILACEÆ.

Smilax
herbacea, L.

LILIACEÆ.

Trillium
cernuum, L.
erectum, L.
———*v.* album, Pursh.
erythrocarpum, Mx.
grandiflorum, Salisb.

Medeola
Virginica, L.

Streptopus
roseus, Mx.

Uvularia
grandiflora, Smith.
perfoliata, L.
sessilifolia, L.

Clintonia
borealis, Raf.

Smilacina
bifolia, Ker.
racemosa, Desf.
stellata, Desf.
trifolia, Desf.

Polygonatum
biflorum, Ell.

Asparagus
officinalis, L.

Lilium
Philadelphicum, L.

Erythronium
Americanum, Smith.

Allium
tricoccum, Ait.

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JUNCACEÆ.

Luzula
campestris, DC.
pilosa, Willd.

Juncus
bufonius, L.
Canadensis, J. Gay. *v* coarctatus, Gray.
effusus, L.
filiformis, L.
nodosus, L.
tenuis, Willd.

PONTEDERIACEÆ.

Pontederia
cordata, L.

Schollera
graminea, Willd.

CYPERACEÆ.

Cyperus
diandrus, Torr.
inflexus, Muhl.
strigosus, L.

Dulichium
spathaceum, Rich.

Eleocharis
acicularis, Torr.
obtusa, Schultes.
palustris, R. Br.

Scirpus
atrovirens. Muhl.
Eriophorum, Mx.
fluviatilis, Gray.
pungens, Vahl.
validus, Vahl.

Eriophorum
gracile, Rith.
polystachyon, L.
Virginicum, L.

Rhyneosphora
alba, Vahl.

Carex
aquatilis, Wahl.
aurea, Nutt.
bromoides, Schk.
Buxbaumii, Wahl.
canescens, L.
————*v.* vitilis, Gray.
crinita, Lam.
cristata, Schw.
Deweyana, Schw.
eburnea, Boot.
Emmonsii, Dew.
gracillima, Schw.
granularis, Muhl.
gynocrates, Wormsk.
Hitchcockiana, Dew.
Howtonii, Torr.
hystricina, Willd.
intumescens, Rudge.
lagopodioides, Schk.
lanuginosa, Michx.
laxiflora, Lam.
————*v.* blanda, G.
————*v.* intermedia, Boot.
limosa, L.
lupulina, Muhl.
monile, Tuck.
Œderi, Ehrh.
oligocarpa, Schk.
oligosperma, Michx.
pauciflora, Lightf.
pedunculata, Muhl.
Pennsylvanica, Lam.
plantaginea, Lam.
platyphylla, Carey.
polytrichoides, Muhl.
Pseudo-Cyperus, L.
retrorsa, Schw.
riparia, Curtis.
rosea, Schk.
scirpoidea, Michx.
scoparia, Schk.
siccata, Dew.
sparganioides, Muhl.
stellulata, L.
———— *v.* scirpoides, Boot.
stipata, Muhl.
straminea, Schk.
stricta, Lam.
squarrosa, L.
tenella, Schk.
teretiuscula, Good.
trisperma, Dew.
Tuckermani, Boot.
umbellata, Schk.
utriculata. Schk.
varia, Muhl.
vulpinoidea, Michx.

GRAMINEÆ.

Leersia
oryzoides, Schw.
Virginica, Willd.

Zizania
aquatica, L.

Alopecurus
aristulatus, Mx.

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Phleum
pratense, L.
Sporobolus
heterolepis, Gray.
Agrostis
alba, L.
scabra. Willd.
vulgaris, With.
Cinna
arundinacea, L. *v.* pendula, G.
Muhlenbergia
glomerata, Trin.
Brachyelytrum
aristatum, Beauv.
Calamagrostis
Canadensis, Beauv.
Oryzopsis
asperifolia, Mx.
melanocarpa, Muhl.
Spartina
cynosuroides, Willd.
Dactylis
glomerata, L.
Glyceria
aquatica, Smith.
Canadensis, Trin.
fluitans, R. Br.
nervata, Trin.
pallida, Trin.
Poa
annua, L.
compressa, L.
pratensis, L.
Festuca
ovina, L.
———*v.* rubra. G.
rubra, L.
Bromus
ciliatus, L.
Kalmii, Gray.
racemosus, L.
secalinus, L.
Lolium
perenne, L.
Triticum
repens, L.
Hordeum
jubatum, L.
Elymus
Canadensis, L.
————*v.* glaucifolius, Muhl.
Virginicus, L.

Danthonia
spicata, Beauv.
Aira
cæspitosa, L.
Phalaris
arundinacea, L.
Canariensis, L.
Panicum
Crus-Galli, L.
depauperatum, Muhl.
dichotomum, L.
glabrum, Gaudin.
sanguinale, L.
xanthophysum, Gray.
Setaria
glauca, Beauv.
Italica, Kunth.
viridis, Beauv.
Sorghum
nutans, Gray.

EQUISETACEÆ.

Equisetum
arvense, L.
hyemale, L.
limosum, L.
scirpoides, Mx.
sylvaticum, L.

FILICES.

Polypodium
vulgare, L.
Pteris
aquilina, L.
Adiantum
pedatum, L.
Asplenium
angustifolium, Mx.
Filix-fœmina, Bernh.
thelypteroides, Mx.
Trichomanes, L.
Camptosorus
rhizophyllus, Link.
Phegopteris
Dryopteris, Feé.
polypodioides, Feé.
Aspidium
acrostichoides, Swz.
cristatum, Swz.
Goldianum, Hook.
marginale, Swz.
Noveboracense, Swz.
spinulosum, Swz. *v.* intermedium.
Thelypteris, Swz.

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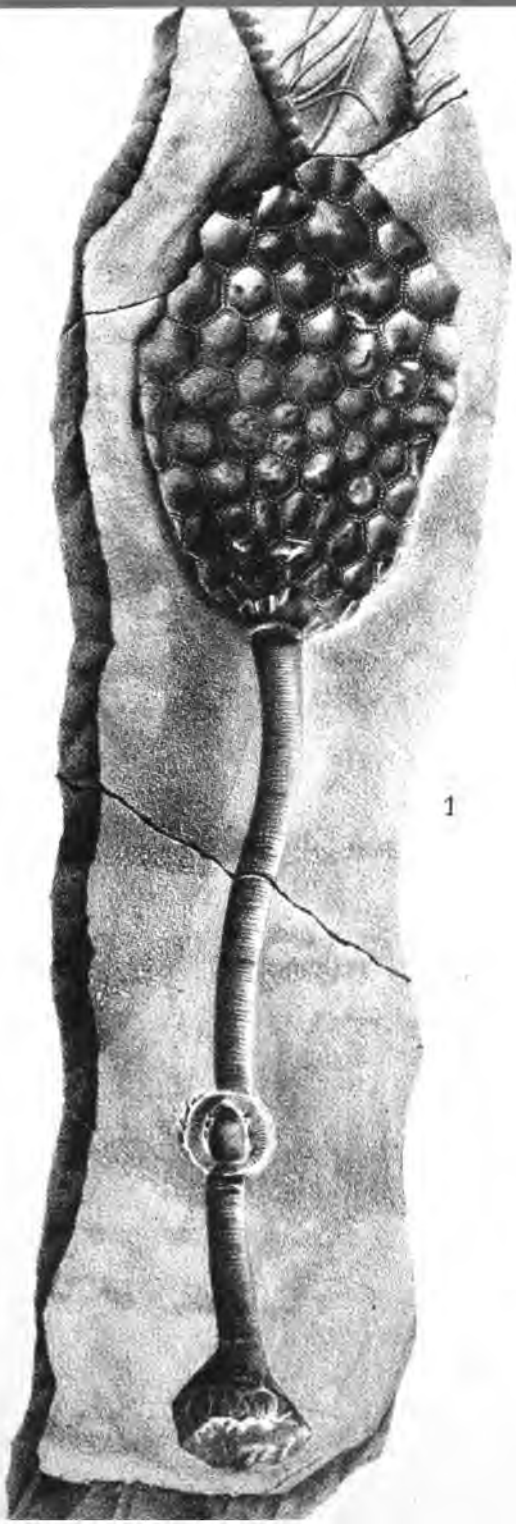

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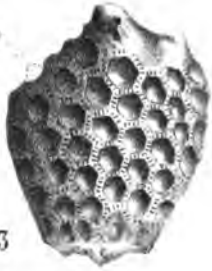

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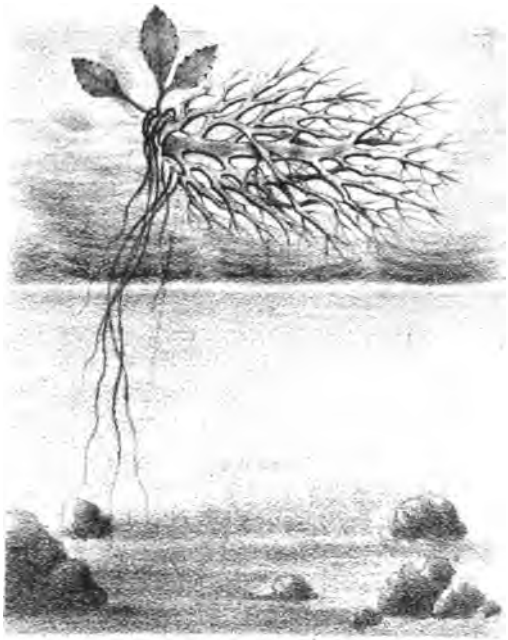

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A. Grignard del.

Woodwardia
Virginica, Smith.

Struthiopteris
Germanica, Willd.

Onoclea
sensibilis, L.
————*v.* obtusilobata, Tr.

Cystoperis
bulbifera, Bernh.
fragilis, Bernh.

Woodsia
Ilvensis, R. Br.

Dicksonia
punctilobula, Kunze.

Osmunda
cinnamomea, L.
Claytoniana, L.
regalis, L.

Botrychium
ternatum, Swartz. *v.* lunarioides, Me.
Virginicum, Swz.

LYCOPODIACEÆ.

Lycopodium
annotinum, L.
clavatum, L.
complanatum, L.
————*v.* sabinæfolium, Sp.
dendroideum, Mx.
lucidulum, Mx.

Selaginella
apus, Spring.
rupestris, Spring.

Description of Plate I.

Fig. 1. *Comarocystites punctatus*, Billings:—Dorsal view of a specimen in possession of Dr. J. A. Grant, probably the largest and most perfect yet discovered.

Fig. 1*a*. Arms and pinnulæ of the same, figured separately to enable the fossil to be depicted natural size.

*Fig. 2. Ventral side of a specimen; *o* the mouth.

*Fig. 3. Left side of a specimen; *o* the mouth.

*Fig. 4. Lateral opening (enlarged).

*Fig. 5. View of summit (enlarged), showing opening and position of arms.

Description of Plate II.

Fig. 1. Leaf of *Nasturtium lacustre*, showing mode of reproduction from the leaves.

Fig. 2. *Pityobius Billingsii*, Bland:—A beautiful and rare Elater, of which this locality appears to be the peculiar habitat. The first specimen was found by the late Mr. B. Billings, and presented to the Entomological Society of Philadelphia, in whose Proceedings for 1864 its description is given. No other specimen is recorded, except the one from which this drawing is made. This (a male) was captured by Mr. W. H. Harrington, at Billings' Bridge, on the 26th June, 1878.

*Figs 2, 3, 4 and 5 are taken from Decade III, Geological Survey of Canada.

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†Fig. 3. *Physa Lordi*, Baird:—Two of the largest specimens found in Meech's Lake, showing the greatest variations.

†Fig. 4. *Limnæa gracilis*, Say:—From a dead but very perfect specimen.

†Fig. 5. *Physa Billingsii*, Heron:—From the largest specimen found, the usual size being much less. This shell was formerly (with doubt) considered by Mr. Heron to be identical with *Physa brevispira*, of Dr. Lea,—for the description of which see Philadelphia Academy of Science, 1864, page 116—but, having collected many more of the shells during the publication of these Transactions, he feels sure that it is a new species, and has given it the above name. Description: shell, ovate, semi-translucid, thick and strong; smooth when not covered with a very slight drab incrustation of dirt; colour, pale greenish drab; whorls, rather more than four, the last very large; suture, distinct, but not very much impressed; spire, prominent, acuminated; aperture, one-half the size of shell; lips, sharp, strongly thickened within with white enamel, which is a continuation of the columellar fold; in many shells there are three or four of these lip thickenings, marking former stages of growth; these thickenings are apt to become yellow with age. Animal, tentacular, with a distinct heavy black line running full length, except at the base, where there is a transparent zone, often broken or disturbed; body covered with minute black spots, which are assembled into what are apparently two lines, diverging from tip of tail, which is sharp. Shell, with animal alive, dark olive; divergence, generally 62 degrees, but, in a few shells, it reaches even 89 degrees; dimensions, one shell (62 degrees), length, half an inch, width, five-sixteenths of an inch; another (89 degrees), length, seven-sixteenths of an inch, width, a little over a quarter of an inch; habitat, Billings' Bridge, near Ottawa, Canada.

†Fig. 6. *Helix nitida*, Muller (enlarged).

†Fig. 7. *Helix minutissima*, Lea (enlarged).

†Fig. 8. *Helix milium*, Morse (enlarged).

These two beautiful plates have been kindly executed for these Transactions by Mr. A. Grignard, who has joined the Club during the present year.

†The above six species of shells are recorded from Canada for the first time.

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LIST OF MEMBERS.

Ami, H.M.
Ami, Samuel F.
Anderson, W. P., *C.E.*
Anderson, Mrs. W. P.
Armstrong, Rev. Wm.

Baptie, Prof. Geo., *M.A.*
Bell, E. B.
Bell, Ernest S.
Bell, J. H., *M.A.*
Bennetts, F. K.
Billings, B.
Billings, W. R.
Boardman, Wm. F.
Bradley, Inglis W.
Bristow, A. A.
Bristow, Mrs. A.
Brough, Jas. S.
Bucke, E. F.
Burgess, T. J. W., *M.D.*
Butterworth, C. A.

Cameron, Rev. A. A.
Campbell, Wm.
Chamberlin, Mrs.
Chesterton, W., *A.C.A.*
Chisholm, A.
Chrysler, F. H., *B.A.*
Clark, T. M.
Cousens, W. C.
Curtis, Smith.

Davidson, A. B., *B.A.*
Davy, R. A., *C.E.*
Dixon, F. A.

Fleming, Sandford, *C.E.*, *C.M.G.*
Fletcher, James.
Fletcher, Mrs. J.

Forsyth, W. F.
Fortescue, L.
Fortescue, Mrs. L.
Fraser, A.

Geddes, W. H.
Gemmill, J. A.
Gisborne, Francis H.
Gordon, J. McD.
Grant, Geo. W.
Grant, J. A., *M.D.*, *F.R.C.S.*, *F.G.S.*, *etc.*
Gray, H. H. O.
Griffin, W. H.
Grignard, A.
Grison, L. A.

Hale, J.
Haliburton, R. G., *Q.C.*
Hamel, F. M., *C.E.*
Hamilton, L. A., *P.L.S.*
Hannington, Rev. E. A. W.
Hardie, John
Hardie, T. Melville
Harrington, W. H.
Harrington, Mrs. W. H.
Harris, Wm. D.
Hay, Geo.
Hector, Thos.
Herron, Gilbert C.
Hine, E.
Hodgins, John

Jarvis, F. A.
Johnson, E. V., *C.E.*

Kemp, Rev. A. F., *M.A.*, *LL.D.*
Kilgannon, A. P.

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LIST OF MEMBERS—*Concluded.*

Latchford, F. R.
LeSueur, W. D., *B.A.*
LeSueur, Mrs. W. D.
Lett, F. P. Austin
Lindsay, A.
Loudon, W. J.
Lowe, John

MacLaughlin, T. J.
Mara, E. A.
Martin, Joseph
Matheson, D.
McLaughlin, S.
McLean, J. D.
Monk, J. B.

Newby, Frank
Nicholson, M. Vernon

Patton, Rev. H. B.
Pettegrew, W. S.
Plunkett, Jas.
Poirier, P. S.

Rauscher, Rudolf
Rinfret, A. P. A.
Ripley, C. J.
Rogers, C. C.

Scott, W. L.
Shannon, S. L.
Sinclair, Miss E. J.
Small, Beaumont, *M.D.*
Small, H. B.
Sowter, E. T. W.
Steers, C. J.
Stewart, J. C.
Symes, P. B., *A.K.C.*
Symes, Miss.

Thorburn, J., *M.A.*, *LL.D.*
Todd, A. H.
Tomlinson, J., *C.E.*

Watts, J. W. H., *A.C.A.*
Watters, H.
White, G. R.
White, Lt.-Col. Wm.
Whiteaves, J. F., *F.G.S.*
Whyte, G. C.
Whyte, J. G.
Whyte, R. B.
Whyte, Miss I.
Wicksteed, R. J., *B.C.L.*, *LL.D.*
Wiggins, E. Stone, *LL.D.*
Wiggins, Mrs. E. S.
Wilson, Miss L. A.
Wood, H. O., *P.L.S.*
Wright, A. P., *M. Inst. C. E.*
Wright, W. R.
Wright, Miss

Young, James

CORRESPONDING MEMBERS.

Macoun, Prof. J., *F.L.S.*, *Botanist to Canadian Government*, Belleville, Ont.

Saunders, Wm., *President, Ent. Society of Ontario*, London, Ont.

Hill, A. J., *C.E.*, Camp D., C.P.R., British Columbia.

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ANNUAL REPORT.

To the Members of the Ottawa Field Naturalists' Club:

The Council elected by you on the 23rd March, 1880, in presenting a report of the proceedings of the year just expired, can honestly congratulate you on the vigorous condition of the Club, as evidenced by increased membership, enlarged work, and extended reputation.

It was not found necessary since the annual meeting to summon any general meeting of the members for the transaction of business. The Council in fulfilment of their duties, met fifteen times, and many extra meetings were obviated by the early appointment of committees, on whom much of the work devolved.

There were, at the opening of the year, the names of ninety-three persons upon the list of members. Of these persons one is dead, nine have left the city, and three have resigned, leaving eighty remaining. During the year, twenty-two new members joined the Club, so that the list now contains one hundred and two names. Although the increase in membership thus shown is only nine, the actual gain of *bona fide* members is almost double that, there being ninety-two paid-up members, as against seventy-seven in the preceding year.

A third corresponding member has been added to the Club in the person of Mr. A. J. Hill, C.E., at present in British Columbia, who has evinced much interest in the success of the Club, and has sent to the President, for examination, collections of insects and plants, of which some species have proved new to Canada.

The summer excursions were well attended, and were successful in all respects. Four only were held; the fifth, which it was proposed to hold on the 9th October, had to be abandoned on account of wet and inclement weather at that season. The first was held on the 27th of May, when the west side of King's Mountain was visited, and a very pleasant day spent in investigating that favorite locality. The second, on the 24th June, was the best attended excursion yet held by the Club, while the place selected, the Chats Falls, had many attractions. Unfortunately, owing to the time occupied in going and returning, the stay at the falls was so limited that members could obtain but a glimpse of the natural products of the locality. The next excursion was held nearer home, on Saturday afternoon, 24th July. The iron mines of the Chelsea hills were visited, and quite a number, in addition to examining the surface operations, descended into the pits and saw the steam drills at work, the overseer very kindly explain-

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ing the various machines and modes of working. On Saturday, the 22nd August, through the kindness of Dr. Wicksteed, who furnished his steam yacht and several boats, the fourth excursion was held to Kettle Island, and the afternoon agreeably spent there. Among the guests present was Prof. Webster, founder of the old Ottawa Natural History Society.

Eight soirees were held during the winter, at which valuable papers were read and interesting objects of natural history were exhibited. The following is the list of papers:—1880—Tuesday, Dec. 7th, Inaugural Address, J. Fletcher, President; Tuesday, Dec. 21st, The Relations between Literature and Science, W. D. LeSueur, B.A.; Herbert Spencer's Biology, J. G. Whyte. 1881—Tuesday, Jan. 11th, On some Fungi found at Ottawa, Rev. A. F. Kemp, M.A., LL.D.; The Chaudiere Gold Fields, R. J. Wicksteed, B.C.L., LL.D.; Tuesday, Jan. 18th, Meteors and Meteorites, H. Beaumont Small; Tuesday, Feb. 1st., Notes on some Diatoms found in the Ottawa, Prof. G. Baptie, M.A.; On some Coleoptera injurious to our Pines, W. H. Harrington; Friday, Feb. 11th, The Brain—the Gymnasium of the Mind, J. A. Grant, M.D., F.R.C.S,. F.G.S.; Notes on some Fossils found at Ottawa, W. R. Billings; Friday, Feb. 25th, Liliaceæ, Lieut.-Col. Wm. White; On the Study of Botany, J. Martin; Friday, March 11th, The Fauna and Flora of the North-West Prairies, Prof. John Macoun, F.L.S.

By request of the Ottawa Literary and Scientific Society, the Council undertook the management of a conversazione for that society on the evening of the 7th January. The programme arranged consisted of music, songs and readings, with a brief paper on astronomy by Mr. Dewe, who also, on the conclusion of the meeting, showed to many of those present, through a powerful telescope, the Moon and Saturn. Microscopes were also provided, through which the circulation of blood in a fish's tail, specimens of diatoms, etc., were viewed during an intermission allowed for that purpose.

At the opening soiree, as well as on the programmes, it was announced that, if a sufficient number of members and their friends desired it, elementary lectures upon botany and entomology would be given by the President and Secretary. Shortly afterwards the Literary and Scientific Society determined to organize a course of science classes, and, in order to assist the society, the proposed classes in entomology and botany were included in their course. It was, however, stipulated by Mr. Fletcher and Mr. Harrington, that all members of the Ottawa Field Naturalists' Club should be admitted free of charge to these two classes. The nightly attendance at the classes has been encouraging, and it is hoped that some who are not yet members of this Club will have aroused in them such an interest in the study of natural history as will lead them to become earnest workers, and valuable additions to our strength.

The following donations and exchanges have been received during the year:—From the Smithsonian Institute, fourteen "Bulletins of U.S. National

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Museum ;" Mr. A. S. Miller, of Cincinnati, "American Palæozoic Fossils," "Cincinnati Quarterly Journal of Science" (three volumes, 1874, 1875 and 1880), and "Contributions to Palæontology" (two pamphlets) ; The Epping Forest and County of Essex Naturalists' Club, "Transactions" to date (three parts) and 'Rules ;" H B. Whitton, Hamilton, "Constitution and By-laws of the Hamilton Association" and "Selenography ;" Mr F W. Webster, "Notes upon the Food of Predaceous Beetles ;" Mr. W. H. Harrington, Vol. X. "Canadian Entomologist," Part I., Vol. I., "American Entomologist," "La Mouche ou La Chrysomele des Patates," and "Some Wood-eaters."

In accordance with a vote passed at the last annual meeting, the Council have caused to be printed the "Transactions" (No. 1) of the Club for the year 1879-1880. Included therein are the list of officers, list of members, rules report of Council, inaugural address, and such papers as dealt with the natural history of this vicinty, or with the original researches of members. These are contained in a well printed pamphlet of sixty-two pages, enriched, through the kindness of Mr. Grignard, by two fine lithographic plates. The Transactions are certainly most creditable to a young club, and have been so recognized and welcomed in every direction, deservedly obtaining for this Club a reputation, to enlarge and retain which will call for well directed and energetic work in the future. Exchange of publications has already been requested by influential societies in Canada, the United States and England, and complimentary notices have appeared in papers and periodicals of these countries The Club has thus been brought into contact with kindred societies, and henceforth must strive to preserve the good name it has so soon acquired in the scientific world. Five hundred copies were obtained at a cost, including plates, of $78.43. Toward payment of this amount, the sum of $28.54, the balance in hand from 1879-80, was appropriated, and the Council is happy to inform you that the remainder has been defrayed by receipts from the sale of copies, of which 175 are yet held by the Club for future sale or distribution. Your attention is strongly urged to the value of these Transactions, both to individual members and to the Club.

Annexed is the Financial Statement for the year, wherein you will find that, after the settlement of all accounts, the Club is in possession of the extremely satisfactory balance of $55.52.

BALANCE SHEET, 1880-1881.

DR. *The Treasurer in account with Ottawa Field Naturalists' Club.* CR.

To Balance on hand	$ 28 54	By Stationery, Printing, etc	$ 12 85
Members' Fees	50 50	Excursion Expenses	57 00
Excursion Receipts	63 20	Soiree Expenses	8 50
Soiree Receipts	20 70	Cost of Transactions	78 43
Sales of Transactions	49 36	Balance on hand	55 52
	$212 30		$212 30

W. H. HARRINGTON,
Treasurer.

15th March, 1881.

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FIRST SOIREE.

INAUGURAL ADDRESS.

DELIVERED ON TUESDAY, 7TH DECEMBER, 1880, BY JAMES FLETCHER, ESQ., PRESIDENT OF THE O. F. N. C.

Members of the Field Naturalists' Club; Ladies and Gentlemen:

As President it is again my pleasant duty to congratulate you upon the successful termination of another collecting season, and the beginning of a new course of winter meetings. The programme promises to be unusually interesting, and will, I trust, induce a large attendance of the members, as well as of their friends.

Full details of the excursions held by the Club during the summer will be furnished in the Annual Report of the Secretary, and it will be, consequently, unnecessary for me to mention more than some of the most important points with regard to them. The first excursion was held on the 27th May, to the west side of King's Mountain, Chelsea, the rendezvous being in a grove of maple trees at the foot of a lovely little waterfall, which came foaming down the mountain side, among the green ferns and mosses, with fairy-like effect. Two days after this excursion, the Montreal Natural History Society held their annual field-day at Lachute, and it was with much regret that the Council was compelled, on account of the time that would have been occupied in travelling, to abandon the idea of making it a joint excursion of the two clubs, like the one held last year. The second excursion, to the Chats Falls, brought out a large number of members, and was an extremely enjoyable one, notwithstanding a few *contretemps*. The third excursion, to the Baldwin Iron Mines, was very interesting, and our members received much kind attention from all employed there, especially Capt. Simmons, the overseer, who escorted a party down the mine, and explained all the apparatus. On the 24th August the fourth excursion was held, to Kettle Island, Dr. Wicksteed generously placing his steam yacht and four large boats at the disposal of the Club for the purpose. Another excursion, arranged for the 7th October, had to be abandoned on account of unfavorable weather.

During the past year we have published our first Transactions, which are certainly most creditable to the Club, an opinion which has been expressed by other societies in different parts of the country, as well as by several magazines, among others *Science Gossip*, in England, and the *Popular Science Monthly*, in the United States. This number of the Transactions is embellished by two plates beautifully executed by Mr. Grignard; but, I am sorry to say, it does not contain all the papers read before the Club, the Council having decided to publish those only which treated directly of local matters.

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To the list of our corresponding members the name of Mr. A. J. Hill, C.E., has been added. This gentleman is now employed on the Canadian Pacific Railway in British Columbia, and has already forwarded to the Club several parcels of plants and boxes of beetles, including some species which had not previously been found in Canada. You will see on the programme that Professor Macoun, another corresponding member, has promised to give us a lecture upon his explorations in the North-West.

I have been able to make a few additions to the Museum of the Ottawa Literary and Scientific Society from the specimens collected by our members, and hope during the winter to receive some more, as the collections of the past season are sorted out.

In last year's Inaugural Address I gave a sketch of the life-history of a plant, and tried to point out some of the interesting features in vegetable life, with the object of inducing some of you, who had not previously done so, to take up botany as a study; and I am happy to say that a few have joined the botanists of the Club during the summer. With a view of aiding the efforts of these beginners, I propose, if a sufficient number of members express a desire to attend, to give, during the coming winter, a series of elementary lectures upon botany and the way to study it, while Mr. Harrington and myself will be glad to undertake similar lectures on entomology. The number of entomologists in our Club is, I am sorry to say, very small, and yet there is not a single branch in the whole of natural science which affects so directly every member of society, owing to the vital relations that exist between insects and the natural products of the country.

One of the most apparent of the many advantages to be derived from the study of natural history is its tendency to methodize the mind by impressing it with habits of order and exactness, thus producing all the good effects of mathematics and logic without the drudgery which to many is found in connection with those sciences; and this is peculiarly the case with that portion of natural history which treats of the insect hosts. Their great number and diversity; their beauty of color and form; their metamorphoses, complexity of structure and peculiarities of habits, always exactly adapted to the purposes they have to accomplish, unite to give an interest to this delightful pursuit not possessed by many others.

One would suppose that, in a country like Canada, where crops of all kinds suffer so severely from the ravages of insects, the practical value of entomological studies would be duly appreciated, especially by the agricultural community. But, unfortunately, such is not the case, and these "minims of creation" individually so puny and weak, but which, united, form such irresistible forces, are to-day very little more studied, by the people most concerned, than they were fifty years ago. I shall endeavor to show that everything

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which is generally designated by that expressive word "bug" is not an enemy to be executed at once without a trial. It cannot but be a matter of considerable surprise to any person who turns his attention to the study of entomology to find to what an extent, comparatively speaking, that branch of natural science is neglected by scientific men, for, notwithstanding the large sums of money devoted yearly by wise governments towards its encouragement, and the untiring efforts made by individual students to present it to the masses in a popular form, it must be acknowledged that as yet it is not studied nearly as much as it deserves.

Little attention was paid to natural history previous to the commencement of the last century, although the writings of some of the leading philosophers of antiquity show that it was considered of sufficient importance to receive special study. Aristotle and Pliny, the elder, wrote of insects largely, although, it is true, somewhat erroneously at times. They too often fell into that trap which is still set in the path of modern investigators, namely, allowing their imaginations to carry them away from the truth to build up a previously conceived theory. Speaking of Dr. Leidy, "the most distinguished naturalist of America," a recent writer has said :—"In the performance of his scientific work he has confined himself to the duty of accurately describing what he has seen. He very rarely draws inferences from his accumulated facts, and his innate truthfulness is such as to deter him from theorizing." (*Popular Science Monthly*, V. xvii ; p. 691.) There are few naturalists, probably, to whom similar praise could be given.

The first book published in England on insects alone is said to have been Mouffet's "Theatrum Insectorum," which appeared in the reign of Charles I., after having passed through the hands of five learned doctors, all of whom did something towards its completion, and after having taken about one hundred years to finish. It was owing to the efforts of Ray and Linnæus, ably assisted by their contemporaries Reaumer and DeGeer, that entomology was raised to its proper place among the sciences. Since their time many learned men have fought hard to keep it there, until now "the laugh at entomology is nearly spent, and known professors of the science may meet in open conclave to exchange observations without fear of becoming subjects for a commission *de lunatico inquirendo*, and may now, net in hand, chase their game without themselves being made game of" This, however, was not the case in the last century, for we are told in Kirby and Spence's "Introduction to Entomology" that an attempt was made to set aside the will of a rational woman (Lady Glanville) on the ground of insanity, which was evinced, it was claimed, by her fondness for collecting insects.

Foremost of all the great powers in the prosecution of scientific research is undoubtedly the Government of the United States. Its official publications upon scientific matters are simply magnificent, and the generosity with which it

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distributes them to institutions and societies, where they can be freely consulted, is worthy of all praise. No one ever need be at a loss for information upon any ordinary scientific point, for on writing to the proper Department in Washington he will receive an answer by the return mail.

By means of the generous assistance of the Ontario Government, the Entomological Society of Ontario is able to put in the hands of all the agriculturalists of the Province information with which they can fight most of the common insect pests, and at the same time learn to determine which among the countless hordes of the insect world may be ranked as allies.

The naturalist founds his studies upon the theory that nothing in nature is useless, and that everything that is must have some special function to perform or it would not exist; it is in tracing up these special adaptations to certain ends that he finds the charm which enables him to carry on the laborious investigations which are often necessary.

As every one knows, vegetable and animal life are the two agents which nature employs to keep up the balance of creation, the one feeding upon or deriving its nutriment from the other. Now, these two agents are, to a certain extent, acted upon and kept in check by their own component parts. Whenever, owing to particularly favorable circumstances, too many seeds of any one species of plant spring up in the same place, they do not all mature, for if they did all would be sickly from want of light and air, and the species would gradually degenerate. Consequently, it is provided that the weaker should be kept down and choked to death to make room for their more robust companions. This is also the case in the animal world, as, for instance, with insects. When, from special circumstances, any one species is abnormally multiplied, it is sure to be attacked and kept in check by some other kind, which itself may be a prey to another species. Plants, through all their stages, from the seed to the decaying leaf, are the orignal source of support to some form of animal life; wherever vegetable life is profuse, there insects abound. The green plant attracts innumerable small insects; these in their turn attract larger carnivorous species, which are again preyed upon by birds and reptiles, and the larger carnivorous animals follow. The flesh feeders, thus depending one upon the other for subsistence, have an ultimate dependence upon vegetable life; therefore, wherever there is the greatest variety of vegetable life there will necessarily be the greatest variety of animals, whether quadrupeds, birds, reptiles or insects.

It is estimated that insects comprise no less than four-fifths of the whole animal kingdom. While there are about 55,000 known species of animals, excluding insects, the number of these amounts to upwards of 200,000. It is therefore manifest that they must perform some very important mission in the economy of nature. "It would be easy," writes the Rev. J. G. Wood, in "Insects Abroad," "to show how the very creatures that are most detested by man, and do him the

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most direct damage, are indeed, though indirectly, among his best benefactors. Apart from direct benefit or injury to man, the whole of the insect tribes are working towards one purpose, namely, the gradual development of the earth and its resources. The greater number are perpetually destroying that which is effete, in order to make way for something better; while others, whose business seems chiefly to be the killing and eating of their fellow-insects, act as a check to their inordinate increase, and so guard against the danger of their exceeding their proper mission."

I will borrow from the same author two more illustrations of the fact that even those insects which we consider most noxious are, in certain important respects, good friends. What more annoying creature can the mind conceive than the common mosquito? Truly is Beelzebub ("King of the Flies") rightly named if these are types of his subjects. I need hardly remind you of the tortures we all endured at our first excursion; it must be remembered, however, that devouring field-naturalists is not the normal occupation of mosquitoes; their real object is a beneficent one. In the deep dark forests of the tropics the air would be perfectly stagnant, and an enormous development of noisome fevers would be the consequence, if it were not for the motion caused by the wings of these and myriads of other minute creatures. In the larval state, too, they live in water, and feed upon the particles of decaying matter which are too small to be noticed by the larger aquatic animals. Were it not for the presence of these insects, which swarm in vast armies in all stagnant water in warm climates, thus purifying it as well as the atmosphere, such localities would be uninhabitable by any animals higher than reptiles. Again, strange as it may appear at first sight, if it were not for the existence of the many borers and wood-eating insects we could have none of those lovely forests which give so much beauty to our landscapes; and are the source of so much wealth to the country. Let us imagine that all these insects have been destroyed at one fell swoop, and note the consequence. A giant of the forest dies, and in course of time, during some winter storm, is blown down. Where it falls there it lies, and nothing can grow from the space it covers. Time rolls on and tree after tree falls, until the whole ground is covered with the trunks and limbs of fallen trees, and what was once a stately forest, with all its wealth of life, is now a vast wilderness where nothing can grow. How different is the beneficent operation of nature under the present conditions; scarcely has a tree shown signs of declining vigor than the insect hosts are at work. First of all come certain species which pick out any weak point and deposit their eggs there. The larvæ in due time hatch, and, eating into the tree, accelerate its decay. When it dies and falls to the ground it is immediately pounced upon by the large wood-boring beetles, which deposit their eggs upon the bark. These hatch into grubs armed with strong jaws with which they soon bore into and through the trunk, thus rendering it permeable to air and moisture. Smaller beetles and other insects follow in the wake of the larger, and bore out the softened decaying wood, some

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using it as food, others as materials for their nests. The rapidity of the work of destruction is astonishing, and in an incredibly short time, the giant which had taken hundreds of years to mature is reduced to mere dust, which serves as a fertilizer of the soil, and enables it to produce fresh trees to fill up the gap left by the one which has gone.

It is questionable whether any good results would follow from giving statistics of the amount of damage done by insects at different times, for so enormous are the figures that could they even be appreciated they would not be believed by those who do not make a study of the matter. It was estimated by Mr. B. D. Walsh, a careful observer, that in 1861 the injury caused by insects in the State of Illinois alone amounted to twenty million dollars, and that the damage done by insects in the United States cannot be less than three hundred million dollars annually.

It may not be out of place here to say a few words with reference to scientific nomenclature. There appear very frequently in the different newspapers accounts of the depredations of insects, and, that these may be concise and explicit, it is absolutely necessarv that some of the technical terms of Entomology should be used. But this is not pleasing to the agricultural classes, "for," say they, "how do we know what such terms as hymenopterous, coleopterous, or dipterous, which are so frequently applied to insects, mean?"

If they take an interest in their own affairs they should make a point of finding out what these terms mean. No one suffers more from these hosts than they do, and it is ridiculous to think of their remaining inactive spectators when it is in their power to avert, or at least, diminish the evil by following the instructions given in the works of Entomologists. To be in a position to do this they have simply to learn the meaning of about a score, at the most, of classical words. Now let us consider what would be the result of their taking this trouble. In the first place, Entomologists would be led to write brief and popular accounts of their researches, and in the second the farmers themselves might be enabled to furnish to more systematic students, as the result of their own observations, data of the greatest importance. Curtis in his "Farm Insects," expresses himself as follows: "It is a great mistake to suppose that scientific descriptions and nomenclature ought to be employed for the use of those only who are specially engaged in the study of Natural History. If insects be not thus accurately described, and their names learned carefully, the facts noticed by practical observers are generally worthless, and may tend to mislead, by the confusion of one species with another, and the subsequent adoption of improper remedies. It is thus that I have found, in extensive reading on these subjects, that a very large amount of the information given by practical agriculturalists and gardeners has proved valueless in cases where, if the particular species alluded to could only have been identified, it would have been of the greatest value in furthering subsequent investigations."

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But why, it may be asked, use Latin and Greek, why not use English Firstly, because English is not spoken in all parts of the globe, while Latin and Greek are the universal languages of the learned in all countries, and secondly, because the very nature of these languages particularly adapts them for the purpose. In Natural History it is frequently necessary to distinguish very different and very approximate forms, and it is of the greatest importance that the difference perceptible to the eye should be explained by precise terms in a concise and readily understood language, and Latin has been unanimously chosen by scientific men. When, however, as is occasionally the case, that tongue is deficient in a characteristic expression, the example of the early writers is followed and application is made to the Greek, which, from the euphony of its words and the fullness of it tones, is well adapted to the construction of permanent names of orders and genera.

There has been great difference of opinion among entomologists as to what orders in the animal world the class INSECTA should include, and perhaps even more upon the division of these orders into sub-orders. As Dr. Packard's "Guide to the Study of Insects" is the only manual we have here, it will be well to follow the plan there presented in drawing a short sketch of the class.

Insects are divided into three orders :—

1. HEXAPODA, or true insects, which have six legs, and attain the perfect state, in which they generally possess wings, through a series of stages of existence, or metamorphoses, known by the names of the egg, the larva or caterpillar, the pupa or chrysalis, and the imago or perfect insect. Upon examining the body of a perfect insect, it will be seen that the portions of the body are more distinctly separated than they were during its earlier stages and that now the segments of the body are collected into three chief regions,—the head, the thorax, and the abdomen. It is from this division of the body that the word insect is derived. Aristotle called insects *entoma*, from *entemnein* = to *cut in*, and the Roman writers, following him, called them *insecta*, from *insecare*, which also means to *cut in*, and this name has been adopted by all later authors.

2. ARACHNIDA, or spiders, which have the segments of the body grouped into two regions, and have eight legs, but no wings; they pass through no metamorphoses, but grow by frequent moultings of the skin.

3. MYRIAPODA, or centipedes, which have the body worm-like, without wings, and the segments not grouped into regions (except in the newly hatched young), have no metamorphoses, and grow by the development of additional rings to the body.

We will turn our attention to the first of these orders. The true insects are divided up into seven sub-orders, according to the structure of their wings, and these again are grouped together into two series, according to their relative

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rank and affinities. The first and higher series has the body usually cylindrical, mouth parts more generally formed for sucking ; metamophoses complete, larva usually cylindrical, very unlike the adult. The sub-orders embraced by this series are Hymenoptera, Lepidoptera, and Diptera.

The second and lower series, has, usually, the body flattened, mouth parts adapted for biting, metamorphoses complete, larva flattened and often resembling the adult and comprises Coleoptera, Hemiptera, Orthoptera, and Neurcptera.

The three regions into which the segments of the six-legged insects are grouped, are known by the names of the head, the thorax and the abdomen. *The head* carries the special sense organs, as the eye, the mouth, and the antennæ. The eyes are wonderful structures, and are constructed to cover a very large field of vision ; they consist, first of all, of two large compound eyes, made up of numerous small six-sided facets, which are so numerous that Leeuwenhoec is said to have counted as many as 8,000 in the eye of a fly, and Strauss 8,820 in that of a cockroach ; besides these two compound eyes, there are in many insects two or more simple eyes (*ocelli*) arranged across the forehead, they can be easily seen in the common Humble Bee. There are some insects which have only *ocelli* and even some with no eyes at all.

The principal organs of the mouth are six in number, two on each side of the opening, one above and one below, the upper single organ is the upper lip or *labrum*, the lower the *labrum* or lower lip, this lower lip has a basal joint (*mentum*) supporting a more flexible part (*ligula*) ; the upper or inner integuments of the *ligula* is usually developed into a kind of tongue, which is a distinct part (*lingua*) in the locusts and dragon flies ; the superior pair of the lateral organs are the upper jaws or mandibles, which are generally hard and serve to tear the food, the inferior pair are the lower jaws or maxillæ, which are generally soft and serve to carry the food to the gullet, to be swallowed. To the lower jaws and under lip are attached short jointed processes, called *palpi* or feelers. These oral organs are the same in all insects, although the structure is vastly different among those which obtain their food by mastication and those which obtain it by suction ; by dissection and comparative anatomy, however, it can be shown that they are identical, only greatly modified in form, in both of these classes. In biting insects, as beetles, the side pieces are short, far apart, and have a horizontal motion, and the upper lip is a flat plate closing the mouth above ; with sucking insects as mosquitoes, the same parts are elongated into lancet-like organs, are close together, and have a longitudinal motion, and the lower lip at the same time is developed into a tube, which encloses them. In Lepidoptera the three upper organs are very feebly developed, while the maxillæ are elongated into a delicate proboscis, the identification of which with the maxillæ is shown by the occasional presence at its base of a pair of minute palpi ; the lower lip is soldered to the head, but is furnished with a pair of palpi, well developed and

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clothed with scales, which act as a protection to the proboscis. In the flea the middle lancet seems to represent the upper lip.

In bees the lower lip and maxillæ form together a sucking apparatus, but they are also provided with well developed upper jaws or mandibles.

In the front part of the face of an insect are two appendages, which vary very much in form, in the different sub-orders and genera, and even in the sexes of one species; they are called antennæ. What the exact functions are of these important organs, is not known, but it is probable they have more uses than one. Experiments have been made with moths in which it was observed that if the antennæ were removed the insect seemed unable to direct its flight. It is probable too that the olfactory nerve is situated in the antennæ. The different forms which the antennæ take have been made use of by entomologists in classifying insects.

The next division of the body of an insect is the *thorax*. This is the solid portion which bears the organs of locomotion, and comprises the three segments which follow the head. The first one is called the pro-thorax and bears the first pair of legs, the next or middle segment is called the meso-thorax and supports the second pair of legs and the anterior pair of wings, the third segment is called the meta-thorax, and to it are attached the third pair of legs and the hind wings. The wings are objects of great beauty and strength, and consist, as a rule, of a double membranous plate, traversed more or less, by bony veins.

The last division of an insect's body is the *abdomen*, which consists of a series of segments attached by membranes. Each of these segments is formed of two arcs or semi-segments, one above and the other below. The abdomen is the seat of the organs of reproduction and alimentation. The senses of insects are dependent upon the nervous systen, which consists of a series of nervous masses or ganglia, joined together by two nervous threads, the whole constituting a nervous chain, from which nerves ramify to the different organs, enduing them with the various senses they possess; from the first ganglion the nerves of the eyes and antennæ are fed, and from the second the mouth. Hearing and smell are certainly possessed by insects; but their appropriate organs are not ascertained. They also possess taste, sight, and touch, the latter being seated probably in the antennæ, the palpi and in the tarsi of the feet.

The circulatory system is well represented in insects. The blood is generally colorless, but occasionally of a greenish or reddish hue. The heart, which comprises a series of large reservoirs in the form of a long tube plainly discernible through the transparent skins of caterpillars, lies above the alimentary canal on the upper surface of the body.

Insects do not breathe, like large animals, through their mouths; but by means of breathing-holes in their sides, which connect with two great air canals

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(*tracheæ*) which run along the sides of the body, and from which smaller tubes convey the air in very small volumes to different parts of the body, and so oxygenate the vital fluid in its passage. In the *Arachnida* this tracheal system is considerably modified, respiration being effected among some spiders by ordinary ramified tube-tracheæ, and among others in certain sacs or cavities in the abdomen which have been called pulmo-branchiæ from an idea that they partook both of the nature of the lungs of the higher animals and the branchiæ or gills of fishes; as, however, the blood does not penetrate these sacs, but is merely oxygenated in its passage by and round them, while it is being re-collected after use and previous to being sent back to the dorsal vessel or heart, these cavities are now believed to be tracheæ localized within a peculiarly furnished sac. Tube-tracheæ when examined with the microscope are wonderfully beautiful. Traversing as they do the whole bodies of insects, they must necessarily be very flexible, and it might be supposed that the rapid movements of the insect might sometimes cause them to collapse, in which case the circulation of the air would be stopped. Upon examination we find that there is a beautiful and simple contrivance which renders this impossible. The tubes consist of a double integument between which runs a hair-like spirally-twisted fibre, just like the coil of wire which is sometimes put inside indian-rubber speaking tubes; this adds considerably to the elasticity of the air vessels, and when these collapse through the movements of the insects, it prevents the opposite sides from adhering, and causes them to resume their tubular form as soon as the pressure is removed. There are generally nine pairs of breathing pores or openings through which the air is admitted into the tracheæ. These openings are so constructed that it is impossible for the dust to enter the tracheæ. At the outside orifice is a corneous plate, and inside that is a hollow chamber, and then at the other side of that is another valve. In perfect insects nearly all the air enters through the thoracic spiracles.

"When an insect is preparing itself for flight, the act of respiration resembles that of birds under similar circumstances. At the moment of elevating its elytra and expanding its wings, which are indeed acts of respiration, the anterior pairs of spiracles are opened, and the air rushing into them is extended over the whole body, which by the expansion of the air-bags is enlarged in bulk, and rendered of less specific gravity; so that when the spiracles are closed, at the instant the insect endeavors to make the first stroke with, and raise itself upon its wings, it is enabled to rise in the air, and sustain a long and powerful flight with but little muscular exertion." In the pupal and larval state respiration is performed almost equally by all the spiracles; but in the imago almost all the air enters by those in and near the thorax, so that, generally, a pinch under the thorax will kill most soft-bodied insects by suffocating them.

Perhaps no sub-order of insects presents more examples of wonderful instinct and exquisite adaptation of their forms and habits to required ends than

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are to be found among the Hymenoptera or membrane-winged insects. It is on account of the highly developed instincts, exhibited in the care they take in providing for their young and in laying up stores for winter use, added to the important part they play in the fertilization of many plants, that they have been placed first in Dr. Packard's system of classification. I shall speak later on of the relations between insects and plants, and will now direct your attention to a few points in the life history of insects which have seemed to me to be of more interest than usual.

By far the larger proportion of these insects are beneficial, and feed either in the larval or perfect state upon other insects. Of beneficial insects mention must first of all be made of the honey bee, concerning which alone whole volumes have been written; and afterwards of the various wasps and allied genera which feed upon and store up for the sustenance of their grubs, enormous numbers of caterpillars, and other insects, as well as acting as scavengers. Among the social bees, wasps and ants, there are found not only males and females, but also other kinds of individuals which are necessary for the successful propagation of the species; these are called neuters, and sometimes laborers or nurses; they are, however, essentially females, having the female organs, but in an imperfectly developed and passive state, their sting being only an accessory part, which is changed into a special weapon of defence, and is the homologue of the ovipositor in fertile female insects. The worker bee, besides collecting the honey and pollen which is to serve as food for the offspring of the queen, has to carry the eggs from the queen to their proper cells and feed the larvæ when they are hatched; they are therefore indispensable for the propagation of the race.

I class wasps among beneficial insects, because the sting for which they are dreaded is never used against man, except as an instrument of defence, while its proper use is the destruction of his enemies, the caterpillars of numerous noxious species of insects.

Although some members of the wasp family do fill their cells at certain periods with honey, the food of the greater part, undoubtedly, consists of animal matter, chiefly other insects, which they either seize with their mandibles, or, when it is to be stored away for the use of the larvæ, sting to death. The poison introduced by the sting owes its virulence to the presence of a peculiar acid known as formic acid. This acid is said to be chemically very similar to chloroform, and its action upon insects stung to death is very peculiar. It does not kill them at once, but paralyzes them, so that they live for many days, and, in some cases, larvæ have been known to turn into pupæ after having been stung, but have not had sufficient strength to complete their final change into *imagines*. The use of this antiseptic property of the poison is easily seen. The mother wasp, having

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prepared the nest for her young, fills it with insects which she has stung; she then lays an egg and closes up the nest. Upon the grub hatching it has a larder well supplied with provisions which will keep fresh as long as required for it to complete its transformations.

The Ants do not demand much of our attention in this country as either injurious or beneficial insects, although there are a few species which are occasionally troublesome, and destructive to posts and fences. The almost human aspects of ant-life, however, as exhibited by different species, provide a favorite study for the entomologist, and an investigation of them could not fail to fill even the least curious with wonder and amazement. Their dwellings are constructed on the most scientific architectural patterns; some species have their cows (*aphides*), which they tend with the utmost care. There are some again which make expeditions against less powerful ants, and carry them off to serve them as domestic servants, they themselves becoming entirely dependent upon the assistance they thus secure, so as to be almost helpless without it. Others, notably the celebrated Agricultural ants of Texas, cultivate the ground, reap the harvest, and store up the grain.

Of all insects beneficial to man, none, perhaps, surpass the ichneumon flies which are parasitic upon the larvæ of various insects. This is an enormous class embracing insects of all sizes, according to the size of the insects they infest. *Rhyssa lunator*, the largest found in this country, has a body nearly an inch and a half long, and an ovipositor of upwards of four inches, while there are some which are so small that they can only be distinguished by the aid of a strong magnifying glass. No class of insects seems to be exempt from the attacks of these freebooters; and with them there does not even seem to be honor among thieves, for nearly every species has a parasite of its own class. As a rule, the parent fly has at the end of the abdomen a long pointed instrument with which she pricks a hole through the skin of a larva, and down which she passes an egg which, in time, hatches into a white, footless, eyeless grub, inside the skin of the caterpillar. Now, I have said that most insects breathe through breathing-pores in their sides. These, however, are an exception, and have their spiracles in the tail. The first care of the newly-hatched grub is to find one of the caterpillar's breathing-pores and fix its tail to it, so that it may breathe the air. It then sets to work and feeds upon the body of its host until fully developed, when it eats a hole through the skin and escapes.

Before closing this, I fear, already too long address, I feel constrained to direct your notice to some of the contrivances by which Nature provides that the flowers of plants may be visited by such insects as may assist in fertilizing the ovary, and may keep away such as are useless.

In order that the ovules contained in the ovary, which is part of the pistil of a flower, may be fertilized, it is necessary that the pollen from the anthers of

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the same, or a different flower of the same species, should reach the stigma or top part of the pistil. Some flowers are capable of self-fertilization; but it has been proved by experiment that it is more advantageous to the future plants that they should be fertilized by pollen from other specimens; and it will be found on examination that there are several very beautiful contrivances by which self-fertilization is prevented. These are either in the structure of the flower or in a difference in the time that the pistils and anthers reach maturity. In some plants, too, the staminate flowers are all borne on one individual plant, while the pistillate are on another; but it is necessary that the pistils should be fertilized by pollen from the anthers, and this is generally effected by insects carrying pollen on their bodies from one flower to another when visiting them in search of honey. To ensure these visits just at the time when the flowers are in full vigor, this nectar is secreted to attract them. Of course, flowers can only be fertilized by pollen from flowers of the same species, and it is a remarkable fact that a bee only visits the flowers of one certain species of plant during any one journey, and further, that honey only developes in flowers just when the essential organs are mature. There is a most remarkable and interesting book just published called "Flowers and their unbidden guests." It is by Dr. Kerner, Professor of Botany in the University of Innsbruck, and translated from the German by W. Ogle, M.D. It is, perhaps, the most valuable contribution yet written towards demonstrating the principle which, I believe, should actuate every student of Natural History, viz.: finding a use for everything that nature has, made. The author holds the opinion that the position, direction, and shape of the leaf is of just as great significance for the preservation of a species as the form, colour and smell of a flower; and that not even a hair is meaningless whether found on the cotyledon, the leaf, the stem, or the blossom. In fact, he proves that these contrivances are formed, among other things (for they have probably more uses than one) for the prevention of those small flying insects, which are too small to touch both the anthers and stigma of a flower, and also those creeping ones which, from not having wings, are unlikely to go immediately from one plant to another, from obtaining the nectar. These contrivances, as I have said, are of many kinds. In some plants there is a viscid ring in the middle of each joint of the stem, as in our own *Silene antirrhina*; in others, as *Polygonum Pennsylvanicum*, the short stalks which support the flowers are embellished with viscid glands. This is also the case in *Linnæa borealis*, the lovely little flower known by the name of Twin Flower. In some the leaves meet in a ring round the stem, and thus form a cup which collects dew and rain, and entirely isolates the stem, and so prevents creeping insects from mounting. In some plants we find thorns, which are most effectual barriers to all soft-bodied animals as snails and slugs. As a rule, too, the closer to the flower the greater is the accumulation; everyone must have noticed that in the common thistle the lower leaves are much less prickly than the upper. The form of the flower, in many instances, acts as a barrier to useless insects. In the common garden antirrhinum, or snap-dragon,

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the mouth of the corolla is firmly closed, and can only be opened by strong insects like humble bees; such small insects as ants are unable to enter. When, however, an insect as large as a bee has entered and covered the stigma with pollen, the tension of the corolla gradually diminishes, and smaller insects can freely enter. Perhaps one of the most remarkable proofs that the hairs often found on the stems of plants are meant as a protection against creeping insects is presented in the variation which takes place in our common water polygonum. When this plant grows in water it is evident that nothing is required to keep off useless *creeping* insects, for it is so isolated that they cannot get at it; but there is a very common form found upon the shore, the whole stem of which is densely covered with rigid hairs; and I have no doubt at all that this is to protect the flowers against creeping insects. One more curious method occasionally found in plants to protect their flowers from creeping insects is the presence of nectariferous glands at the base of the leaves, generally on the petioles; these act as allurements to draw them off. There are sometimes other appliances designed to protect the flower during the time the seeds, the means of reproduction, are maturing; these lie in the actual flower itself. Some flowers have thorns on the calyx and on no other part of the plant; and, again, many plants are preserved from destruction by the presence of certain alkaloids and other chemical compounds, as in *Datura*, *Asarum*, *Solanum* and *Conium* Anyone who has bred butterflies will have noticed that caterpillars will feed upon the leaves of a certain plant, but will not touch the flower; and this is also the case with many ruminant animals—they will eat the leaves, but not touch the flower.

There are many other subjects of vital importance and immense interest to which I should like to direct your attention, but time forbids. The magazines and literature of the day teem with articles setting forth the claims of natural science, and anyone that wishes to keep up with the age must work hard, but I venture to say that his work will have so much interest attached to it that he will find a reward for his labors in a life of unalloyed pleasure.

SECOND SOIREE.

TUESDAY, December 21st, 1880: The first paper of the evening, "The Relation between Science and Literature," was read by Mr. W. D. LeSueur, B.A., who pointed out that the differences between literature and science, as regards the faculties they called into play and the methods by which they worked, were by no means so great as often supposed. To see aright in any branch of study required considerable preparation of mind; and to generalize with success

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either in the region of science or that of literature, required considerable imaginative power. Literature had, under the influence of science, become more definite in its methods and aims, and science, under the influence of literature, had become more popular in its character. Some of the most eminent men of science of recent times were possessed of a high degree of literary power. Both literature and science had suffered somewhat through the vanity of some of their professed students; and there was a tendency on the part of both to degenerate into mere individualism. Both were, however, essentially social in their character, and should therefore be pursued in subordination to social ends. If we were to keep in view the vast debt we owe to the civilization into which we have been born, we should not, as students either of science or literature, seek merely to please ourselves, but should consecrate our best efforts to the cause of humanity.

The second essay, by Mr. J. G. Whyte, on "Herbert Spencer's Biology," gave a most excellent condensation and exposition of the theory so ably advocated by that illustrious philosopher. He pointed out the gradual and widespread change which has taken place in conceptions of the formation and progress of the earth and its inhabitants, so that the once universally accepted theory of special creations and frequent catastrophes has in great part yielded to that of evolution, first brought into prominence by the writings of Darwin. While it is not claimed that this theory will furnish the immediate solution of every problem which greets the student of natural history, it undoubtedly enables him to grasp the meaning of many things formerly unintelligible, to arrange them in proper sequence, and to render them of service in his further studies of the animal and vegetable worlds. As the studies of palæontology, embryology, etc., receive increased material and workers, more of the "missing links" are from time to time unshrouded, and the forms at present inhabiting the earth are more readily traced back to those which existed in far earlier ages.

THIRD SOIREE.

TUESDAY, January 11th, 1881: Rev. A. F. Kemp, M.A., LL.D., delivered an address on "Some Fungi found at Ottawa," first explaining the difficulties encountered by a student in this branch of botany through the absence of works

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of reference or other means of determining the numerous species, many of which require careful microscopic study on account of their minuteness. He then gave an outline of the classification of fungi and a description, illustrated by admirable figures on the black board, of the structure and fructification of several species, selecting such as might be easily found in the neighborhood.

Dr. R. J. Wicksteed, B.C.L., L.L.D., then read an interesting paper on "The Chaudiere Gold Fields," in the Province of Quebec, in which the geological formation of the district was fully discussed, and illustrated by the aid of maps. The various methods of working and extracting the gold were then considered, and models of several of the machines used were shown, as also nuggets of gold from the mines, and packets of unsifted dust, in which could be seen specks of the precious metal.

FOURTH SOIREE.

TUESDAY, January 18th, 1881.—"METEORS AND METEORITES."—MR. H. B. SMALL.

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The phenomenon of shooting or falling stars, or meteors as they are more generally styled, is now acknowledged to have existed since the formation of the solar system, long anterior to the existence of man. On any clear evening it is estimated a watchful observer may see on an average two shooting stars every five minutes, and at certain periods of the year in such abundance as to have obtained the name of meteoric showers. These apparently emanate from some constellation or from a point of space known as a *radiant*, represented by a certain constellation, whilst single meteors appear to come from no particular point, but move in all directions and from every part of the sky. These are styled *sporadic*. In their normal condition these wandering bodies before they reach our vision are known as *meteoroids*, and in their own proper orbit are never visible from the earth. They are then regular circumsolar bodies obeying the laws of motion and gravitation as rigidly as the planets. Striking or rather entering our atmosphere at a speed of forty-eight miles per second, they at once become self-luminous from the heat engendered by friction with the atmospheric medium, and the arrested motion producing a sudden compression of the air. To illustrate this I may mention that there is a little instrument called an air match, consisting of a piston and a cylinder, somewhat like a syringe, in which a light can be struck by suddenly forcing down the piston upon the air below in the cylinder. As the air cannot escape it is suddenly compressed and gives out a spark sufficient to ignite a piece of tinder at the bottom of the cylinder. Some idea from this may be formed of the heat evolved by the motion of a large body in the atmosphere with the velocity of a meteor. A combustible body under such circumstances would be speedily ignited, but could not burn freely till reaching air of greater density; thus on entering the lower portion of the atmosphere it would burn with great rapidity and according to its distance

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be more or less entirely consumed before reaching the earth. It has been estimated that by the time they have traversed a space of fifty miles, the meteoroid, or meteor as it has then become, is heated, melted, evaporated, and extinguished in a period of not less than a second of time. The height from us at which they become heated to visibility is sometimes as much as 200 miles, but the average has been put down at seventy-five miles, and extinction about fifty miles above the earth.

The length of the arc or course they describe in their visible path varies greatly, owing to the position of the observer. One may flash up, increase in size and brilliancy and disappear without seemingly describing any arc. The course of such a one is directly towards the observer, but to another person thirty or more miles distant it would exhibit an arc of several degrees in length.

Different and varied views are held by philosophers as to the origin of meteoroids. One theory is that they are fragments of an exploded or shattered planet filling interplanetary space, most of which through holding orbits round the sun will ultimately fall into that body and serve as fuel for that central orb. To illustrate this, supposing our earth through some gigantic convulsion became disintegrated and burst into numerous portions, these would continue to move on becoming more or less erratic in their movements; the smaller portions would first feel the influence of disturbing agencies larger than the earth, and moving inward would become entangled as it were in the resisting medium in space which is now acknowleged to exist. This resistance would change their orbits, and the lighter particles would form a more erratic orbit than the heavier or denser ones. They would gravitate towards Venus, which lies inside our orbit, and be the first to fall on it, whilst the denser fragments metalloids, and metals would be the last.

Dr. Brewster favors the theory of Meteoroids being fragments of a large planet similarly as the asteroids, the previous existence of which was long ago suggested by the vast chasm between Mars and Jupiter, where only asteroids have as yet been observed Dr. Olbers, the discoverer of three of the known asteroids, held the same idea, and that the lesser fragments coming within the attractive power of a planet would fall towards it, and when entering its atmosphere would go through all the conditions referred to, fusion, luminosity, etc. Sir John Herschell, however, differs from this theory. The diameter of Jupiter, the largest known body in our planetary system, is 80,000 miles, whilst that of Clio, one of the smallest, is only sixteen miles. Chladin, a philosopher at the end of the last century, thought that bodies might exist as much smaller in comparison as Clio to Jupiter, having only sixteen feet diameter, and in the same ratio we come down to one-twenty-fifth of an inch, mere cosmic dust. Myriads of these may revolve in space without our having any knowledge of their existence.

To this comet dust is now attributed by scientists that peculiar fleecy brightness known as the zodiacal light. Any observer of the western sky at this season of the year for about one hour after sunset may see a soft faint cone shaped glow of light extending about forty degrees, following nearly the Sun's path in the heavens. Near the equator when the ecliptic rises high above the horizon it can be seen nearly all the year round, and in a very clear atmosphere in the tropics has been traced all the way across the heavens from east to west forming a complete ring. The theory that now prevails is that the light from the sun when below our horizon reflects on the cosmical atoms of floating star dust and meteoroids is the cause of the soft celestial glow that now lingers evening after evening in our western sky. An illustration of this is afforded by a ray of light which finds its way into a darkened room through a small orifice, revealing as

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motes dancing in a sunbeam the particles of dust floating in the air of the room, but only visible where the entering ray of light falls athwart them.

In this connection the recent deep sea soundings of the *Challenger* have brought to light a curious fact. Sir Wyville Thomson found that beds of sediment were being slowly formed on the deepest ocean floors, but so slowly was the rate of deposition made that it has been compared to the fall of dust in an unoccupied room. No better proof of this can be given than that an examination of the abyssal mud disclosed the presence of an appreciable proportion of meteoric iron the product of those falling stars which dissipate themselves on entering our atmosphere. Professor Geikie says in a recent geographical lecture in Scotland "to learn that mud gathers there so slowly that the very star dust forms an appreciable part of it, brings home to us as hardly anything else could do, the idea of undisturbed and slow accumulation."

An interesting memoir by M. Tschermak, of the University of Wissenchaften was published in 1875 on the source of meteoroids, and a paper on his memoir was last year read before the Royal Irish Academy by Mr. Robert Ball. Techermak claims a volcanic source in some celestial body. Mr. Ball follows the theory further, and by able reasoning shows that if ejected from the planets or asteroids there would only be a chance of one in 50,000 of them falling on the earth. If in the early stage of our own earth's history, long anterior to life, when mighty convulsions were rending it, colossal volcanoes may have existed with explosive energy enough to drive missiles upwards with a velocity which would carry them far enough from the earth to a point where they would continue to move in orbits round the sun, crossing at each revolution the point of the earth's track from which they were originally discharged– if this were the case there are now doubtless myriads of these projectiles moving through the solar system, the only common feature of whose orbit is that they all intersect the track of the earth, and it and they now and then meeting, the point of intersection would be marked by the desent of a meteorite. This theory was hinted at by Dr. Phipson in a work published by him in 1866, and Mr. Lawrence Smith, another later writer on this subject inclines to the same view. No volcano now exists with explosive energy enough to eject fragments that could constitute future meteoroids and if such ever did exist, it could only be in the early stages of the earth's history.

Another and an ingenious theory advanced by Professor Newton of Yale College, and one meeting with general acceptance, is that meteoroids are fragments of or attendants on a comet, and in a lecture of his in 1879 he scientifically endeavors to prove this. Speaking of the recurring November meteoric showers which manifest themselves at their maximum every thirty-three years, he says vast masses of these small bodies move in a long thin stream around the sun, and the earth at stated times plunges through them taking with its atmosphere each time scores of millions of them. Their orbit is described in thirty-three and a quarter years. They go out a little farther than the planet Uranus or about twenty times as far as the earth is from the sun. While they all describe the same orbit they are not collected in one compact group, but taking four or five years to pass a given point in the orbit, they may be likened to a train several hundred million of miles long, but only a few thousand in thickness. Along with this train travels a comet. Every August, about the tenth of the month, there is another star sprinkle or slighter display of meteors (known amongst the common people as St. Lawrences' tears) and a comet whose period is 125 years, moves in the plane with these meteors and in a like orbit. Again early in December there are star showers, the meteoroids composing them travelling in the orbit of Biela's comet. In April slight showers again occur, connected with another comet's orbit. The

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sporadic meteors of nightly occurrence are but outlying stragglers of a number of meteoroid streams, and the leading problem of meteor science to-day is to find these streams and their attendant comets. Professor Newton says the known comets have been apparently growing smaller with their successive returns. Halley's comet was much brighter in its earlier than its later recurrences. Biela's comet has divided into two, if not more, parts, and has perhaps gone altogether to pieces, as it could not be found in 1872 where it should have appeared. The question naturally arises what causes a comet to break up. This is as yet only a matter of speculation, but this much is known that comets surely come from stellar space in whose unimaginable degree of cold a condensing mass furnished heat for the making of a meteoroid. In cooling, or by some internal convulsion the mass may break and enter the solar system either as a mass of pebbles or as one huge body. Nearing the sun new and strong forces act on it. The same heat and repulsion that develop and drive off from a comet in one direction a tail 100,000,000 miles long may have worked off and scattered in another direction solid fragments to wander in their own orbit around the sun, an infinitesimal comet for millions of years—till entering the earth's atmosphere one by one they crash through it either to fall on the ground or to be annihilated by friction before reaching it.

Professor Schiaparelli an Italian authority on these questions regards meteoroids as original inmates or portions of one of what he styles star drifts, and of whose existence decided proofs are given by Proctor, and composing with other stars of the same vast eddy attendant bodies accompanying in its journey through space the general drift or star family of which the sun forms part. On this assumption they are bodies from some more distant space than the star family of the sun, wanderers from more distant star drifts.

The conflagration of a star through contact with meteoroid bodies is not an unknown occurrence. The first on record took place 2000 years ago, and is described by Hipparchus. It was seen blazing in full daylight. Similar events are recorded in 945, in 1264, and in 1572. In 1596 Fabricius observed a similar occurrence, followed by another in 1604. In 1673 another made its appearance, remaining visible for two years, whilst as recently as 1848 a similar event was noticed, and a few years ago, the latest on record, another appeared which was ably written upon by Proctor in an article of his in *Belgravia*. In 1869 two meteoric masses are recorded as having fallen into our sun, affecting the whole frame of the earth. Vivid auroras were seen where they had never before been seen, accompanied by electro-magnetic disturbances all over the world. In many parts the telegraph lines refused to work, signal men received many shocks and at Boston and elsewhere a flame of fire followed the pen of Bain's telegraph. This was the effect of two comparatively small meteors. What would be the effect of a comet, bearing in its flight many millions of these falling into the sun can be understood. It would be only temporary, but no student of science would be left to record it. Proctor reassures us by saying that all but one of the known star conflagrations have occurred in the zone of the milky way, and that one in a region connected with the milky way by a stream of stars, and if among the comets in attendance on our sun there is one whose orbit intersects the sun's globe, it must already have struck it before the era of man.

An interesting question has quite recently been put forward by the *Lancet* the well known English medical publication, respecting the possible influence of meteoric matter on the animal life of the earth. Professor Herschell has succeeded in examining and analysing by means of the spectroscope, the light of seventeen of these bodies, and he has succeeded in detecting the well known yellow bands produced by sodium in combustion. "It is strange," says the *Lancet*, "to consider

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what becomes of all the sodium thus dispersed throughout the upper regions of the air, as there can be no doubt that in some form or other it reaches the earth. The very air we breathe must at all times contain, in however minute a proportion, the cosmical dust thus brought to us from the interplanetary spaces, and as the different meteoric systems are differently constituted, the air we breathe is constantly being impregnated with various forms of metalic dust. It is not certain that deleterious results do not occasionally flow from an excess of some of the elements contained in meteors. Professor Roscoe goes so far as to conjecture that the soda which all accustomed to work with the spectroscope find present everywhere may by its antiseptic properties, exert a considerable influence in maintaining the public health. Speculations and hypotheses of this kind are no doubt interesting, but, it seems to me, barren of utility till proved. And I merely quote from the *Lancet* to show that the study of meteors is attracting other attention than that of astronomers.

Atmospheric electricity is now also being attributed to meteoric influence, and Professor Govi in 1878 leans to the idea that a certain amount of heat is introduced into our atmosphere by the meteors that enter it, and Professor Everett attributes the sudden variations of the needle of the electrometer from no apparent assignable external cause, to the same influence. He adds our great want at present is balloon observation, and he says that he "feels convinced that friction of the air or of the solid particles contained in it is one cause of the generation of electricity in the air."

Scientific theories necessarily lack finality. Sufficient to-day to explain all the known facts, to-morrow's discoveries may show their inadequacy, and lead to their modification or abandonment.

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A description of the most celebrated meteorites here followed, which it is found necessary to omit.

The above was the only paper read at this soiree, as Mr. H. M. Ami, whose name appeared upon the programme for a paper upon the "Iron Deposits of the Ottawa District," was unable through ill-health to prepare it.

FIFTH SOIREE

TUESDAY, 1st February, 1881: Prof. Geo. Baptie, M. A., delivered an address upon "Some Diatoms found in the Ottawa," explaining the nature of these minute organisms and their importance as showing the co-relation and interdependence of the natural sciences. He stated that the Ottawa River was particularly rich in diatomaceæ, and showed the construction of several species, with their delicate silicious skeletons, varying in shape and marking. The lecture was illustrated by figures on the blackboard as well as by a fine set of microscopic slides.

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"ON SOME COLEOPTERA INJURIOUS TO OUR PINES."—W. HAGUE HARRINGTON.

* * * * * * * *

With the exception of a few species, which, (unless they occur in most unusual abundance), can do little or no harm, all our beetles injurious to the pine are comprised in four families, named respectively:—*Buprestidæ*, *Cerambycidæ*, *Curculionidæ*, and *Scolytidæ*.

The family Cerambycidæ contains our largest and commonest pine-borers, such as *M. Confusor*, that large grey beetle with very long antennæ, which is so abundant here in summer and autumn. Its members also destroy much timber, but their depredations are confined chiefly to dying or dead trees, whereas many of the species included in the other families attack living ones. I will therefore leave untouched to-night these very interesting "long-horned" beetles and briefly consider some species from the other families which are found to infest the pines in the vicinity. The first, Buprestidæ, contains some of our handsomest beetles, and all its members have strong, shapely bodies, clad in horny armour so tough that transfixing them with the entomologist's slender lance (a pin) is often quite a difficult matter. Their shape is oblong, the head being sunken as far as the eyes in the somewhat square thorax, which is joined closely to the abdomen. The color varies much in different species, but is usually very striking, and of a metallic-like lustre; golden, coppery, green, and other brilliant tints prevailing.

The largest species is *Chalcophora fortis*, a remarkably fine beetle varying from one to one and two-tenth inches in length and being about three-tenths of an inch wide. Their color is a coppery brown, but newly emerged specimens have often a golden-greenish burnish, or a powdery appearance caused by very minute particles of wood, scattered in the indentations of the elytra and thorax. The brilliancy of their appearance is increased by raised lines and patches on the thorax and elytra which are polished and show off against the remaining surface, as work of burnished metal does against a grained or frosted ground. This beetle is comparatively rare, but perhaps as common in this locality as in most parts of the country.

Chalcophora liberta very closely resembles the last species in its markings, and might readily be mistaken therefor by those not familiar with both. It is smaller, however, being only from three-quarters of an inch to one inch long and is somewhat different in color. It is generally of a bright coppery red, but varies greatly in this respect, specimens being found of all shades from brassy-black or purple to orange-bronze. This beetle, like the preceeding one, is frequently found (especially upon saplings) in the centre of a cluster of leaves, head inwards and in this position would, by the inexperienced observer, be probably taken for a young cone. It appears to feed upon young cones and leaves at such times, and these are probably the food of all the pine-investing Buprestians after reaching the perfect state, as I have found nearly all the species thus situated in the leaf clusters. This beetle, *C. liberta*, is quite abundant, as will be seen when I mention that M. Fletcher and Mr. Greata (a former member of this club) collected with me in one afternoon (21st Sept., 1878), in a small grove of saplings and young trees, over one hundred specimens, and that a couple of days afterwards we collected in the same place over half as many. On the 23rd Sept., 1880, I captured in about an hour 28 (13 males and 15 females) and could easily have obtained more. The larvæ of these beetles had probably bred in trees, or stumps and logs in the neighborhood and had resorted to these saplings to feed and pair.

Chalcophora virginiensis is stated by Fitch to be *always* an inch or more in length, but I have measured a great many specimens and find that few exceed

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an inch in length, the rest varying from seven eights of an inch up to the maximum of slightly over an inch. This species is duller in color than the preceding species, and the raised lines on the elytra are less sharply defined. It can be further distinguished by two impressed spots on each elytron interrupting the the second line. This species have been found by me almost invariably crawling, or at rest, upon the sunny side of the trunk or limbs, instead of among the leaf clusters. Its color tones so well with the bark of young trees that it is not easily seen, until this habit of frequenting the sunny side of the tree is known, when it can be more readily found. We have already noticed that *liberta* closely resembles the young cones and thus have in these beetle two very good instances of protective coloring and habits. *C. virginiensis* is not so abundant as *C. liberta* but is by no means rare and is not unfrequently found about the city on the sidewalks or crawling on houses or fences.

There is great difficulty in determining the complete life-history of the Buprestidæ, as the greater part of their existence is spent within the tree, and the effects of their depredations are seldom apparent until they have quitted their dark winding passages to emerge clad in bright armour for a brief existence in the sunlight. Observations by different naturalists have, however, established pretty conclusively the chief points in the life of the larvæ, many species of which do not confine their ravages to old and dead trees but are found destroying those still living and thriving. The larvæ of these beetles may be readily recognized by the broad flattened segments immediately behind the head; the rest of the body being narrow, thus giving them some resemblance to a tadpole. Commencing life as minute, footless grubs they bore crooked passages between the bark and wood; gradually, as they acquire strength and size, they sink sloping and winding tunnels through the sapwood to some depth below the surface, and when nearing maturity again work upward to the bark and undergo their metamorphoses in the end of the burrow, finally eating through the bark and emerging as brilliant beetles.

I have found in pine stumps a large larva evidently belonging to one of the three species already described, between the larvæ of which there can be but little difference either in size or shape. Last summer I made drawings and measurements of one, which I unsuccessfully attempted to rear. It was two and four-tenth inches long and four tenths of an inch across the widest segment, narrowing afterwards to half this width. These larvæ, in common with those of the other beetles to be mentioned this evening are footless, and move forward in their burrows by muscular expansion and contraction of the segments of their bodies.

Entomologists are at variance as to the time passed by these beetles in the larval state; some thinking that they only spend one year as grubs, and others allowing twice as long. It is only certainly known in the case of a few species, and varies greatly for different genera. My observations made during several seasons seem to establish the fact that the members of the genus Chalcophora make their appearance in two broods, the first in Spring and the second in the Autumn.

Early in May they appear abundantly for a short time, and are found in gradually diminishing numbers until the end of June. During the next two months none are to be seen, but about the middle of September they are numerous and continue so until the end of that month. The appearance of the specimens both in May and September indicates that they have just emerged, for the depressed portions of the elytra are whitened by some powdery substance, apparently like fine saw-dust, which soon rubs off.

During both these periods the sexes may be seen paired and it is my opinion that the beetles from eggs laid in May and June come forth in the Sep-

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tember of the following year, while from eggs laid in September the beetles emerge in the Spring of the second year after. This gives to the larvæ of the first batch an existence of fifteen months, including one winter, and to those of the second a period of nineteen or twenty months, including two winters, during which season of the year the grubs must be more or less inactive, probably entirely so.

Dicerca tenebrosa is a beetle one-half to five-eighths of an inch in length, of robust form and having the wing-covers tapering and prolonged at the tips, and rough looking from the presence of several rows of raised, black spots, separated by spaces densely punctured.

Buprestis maculiventris is a brassy-brown species, from five-eighths to six-eighths of an inch long, common upon both old and young trees in June and July. I am inclined to think that it feeds also upon spruce, as while in Cape Breton last August I noticed a couple of these beetles, in a section wooded almost entirely with spruce, pines being rarely met with. It is easily distinguished by the yellowish-red spots on each side of the segments of the abdomen beneath, and by smaller spots of the same color upon the shoulders of the thorax and upon the face. Its wing-covers are thinner and softer than those of preceding species and often have a rumpled appearance, as if bent in two or three places. It is inferior in beauty to our other Buprestidæ. I have found several of the beetles emerging from the pine timbers of the Maria Street Bridge, about the end of June.

A species closely allied to it, but slightly larger and marked by four yellowish bands across the elytra, is named *A. consularis*. I have never found it upon pine trees but feel confident that, from its similarity to the last species and from having found specimens near lumber yards and on pine structures, it infests the pine. It is somewhat rare in this locality.

Buprestis striata is a handsome beetle five-eighths to six-eighths of an inch long. Each wing-cover is marked by four raised lines and, in the greater number of specimens, by a bright green stripe down the middle. The thorax is covered with coarse punctures, becoming denser and confluent at the sides, and has also a slight glimmer of green. The lower surface of the beetle has the appearance of brightly polished copper. This very beautiful and strikingly marked insect is occasionally taken feeding on the pine leaves in May and June. A couple were taken at the *Chats Falls* on the occasion of our excursion on 24th June last.

Melanophila fulvoguttata is a small brassy-black beetle five-sixteenths to seven-sixteenths of an inch long, the wing-covers bearing each three yellow dots arranged almost in the form of a circle upon the back of the beetle. The surface is very finely granulated and punctured. The beetle is found during June both on spruce and pine.

The last of the Buprestians which I have to describe is in my opinion the gem of them all, so brilliant is it, especially in the sunlight. It is also the smallest, the males only averaging four-sixteenths of an inch in length and the females five-sixteenths. The larvæ inhabit young saplings and the small limbs of larger trees. The beetles are found on the trees during June and July; seeming to delight in the hottest and brightest days of these months, and displaying in such weather great activity, whereas on a cool, cloudy day they are much less alert. When among the leaves they are, from their color, very difficult to see, and if shaken off upon a beating net they take wing with such swiftness as very frequently to escape capture. The instant they drop upon the net they are off like a flash of emerald light. The color of the female is a uniform vivid green or blue-green, with the exception of the antennæ and feet which are black, but the male has the thighs and sides of the thorax coppery or bronzed, and is thus easily distinguished, as well as by his smaller size.

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The members of the family Curculionidæ are very easily recognized by the manner in which the head is elongated; many species having it prolonged into a very slender proboscis or beak, whence they have received the distinctive name of "snout beetles." They are all vegetable feeders and the larvæ invariably live concealed within the substances upon which they feed. Several species do considerable harm to pines, of which the commonest here is *Hylobius pales*, the dark weevil dotted with scanty grey heirs, so abundant about our lumber yards and streets during the greater part of the summer. Its length is about three-eighths of an inch. In May and June the beetle may be observed perforating the bark with its long snout, the end of which bears minute but strong jaws, and depositing its eggs in the holes thus made. The larvæ when hatched burrow between the wood and the bark, loosening the latter and inducing decay in the tree. *H. Stupidus* is a larger beetle, distinguished by having the scutel and the scanty hair clothing the body yellow. Its habits are the same as those of the preceding species but it is far less abundant.

Pissodes strobi, the "white pine weevil" is slightly smaller than the foregoing species but attacks the young trees in a more vital part, and often effects serious damages upon rising forests. It is a chestnut, or reddish-brown beetle, having two little dots on the thorax, the scutel and an interrupted band across the back white, and patches of yellow hair upon the elytra. The leading or topmost shoot of thrifty young pines is the object of its attack, and often in a grove of young trees every one will have the top shoot destroyed. The female bores holes in the bark, in which it places eggs, at irregular intervals the whole length of the shoot, and as soon as the larvæ are hatched they eat downward towards the centre of the twig and burrow in the pith. In the cells thus formed they undergo the necessary changes and emerge the following spring in the perfect state. For a month or two after the eggs are laid the growth of the twig is unaffected, but as the larvæ increase in size it begins to wither and dies very shortly. One of the lateral or side shoots curves upward to take place of the one destroyed, but a crook is thus caused which lessens in a great degree the value of the tree and renders it totally unfit for a spar or mast, which is one of the most important and noble uses to which a pine tree can be devoted. Thus was probably caused the fork in the famous old pine on Bank Street near Patterson's Creek. When the weevils are numerous they also attack and destroy the lateral or side shoots. The only way to prevent their ravages is but cutting off all the dead shoots, in autumn, while the larvæ are in them, and burning them.

The Scolytidæ are closely related to the snout beetles and are often called bark weevils although they have not the elongated heads of the true weevils. They are small beetles, our largest species but little exceeding one-quarter of an inch in length. Their cylindrical shape, abruptly truncated at each end, has led to the remark that they appear as if they had been made by the inch and then cut into small pieces. By perforating the bark and loosening it they injure and destroy many of our forest-trees, their immense numbers counterbalancing their minuteness.

A number of years ago, a train of passenger cars crashed through a high bridge, built of timber and comparatively new, and many lives were lost. The accident was caused by the rapid decay of the timbers and a celebrated entomologist on examining them found that the exterior had been bored by myriads of these little beetles, and water filtering into their tunnels had rotted the wood.

Pityophthorus sparsus is the first on the list, as well as the smallest of those I have found, and it is also very abundant. It is barely one-sixteenth of an inch long; the thorax being dark and the wing covers yellowish. About the middle of May pine saplings may often be seen with drops of balsam oozing out of the

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bark and standing like beads of amber all over the trunk and limbs. Each of these drops show where one of these minute beetles has perforated the bark. On examination many will be found still in their tiny burrows beneath the bark, usually in groups of three of four, and others will be found boring their way through the bark to deposit eggs.

Xyleborus Xylographus is a considerably larger species, measuring between two-sixteenths and three-sixteenths of an inch in length and about one-sixteenth of an inch in diameter. The thorax is nearly as long as the body, and is bluntly rounded in front, the head being deeply sunken in it and almost hidden. The end of the body appears as if a piece had been gouged out, and the sloping tips of the elytra bear several small teeth and are bearded with hairs. The beetle varies in color from yellow to yellowish brown, and, from its habits, has very appropriately been named the "wood-engraving" bark-beetle. It is said by Fitch to be "the most common and probably the most pernicious of all the insects infesting the forests in the State of New York" because "it is liable to attack trees that are in full health and vigor, those that are young as well as old." The beetle bores through the bark, and then tunnels for some distance between the bark and the wood, lengthwise of the trunk or limb. Along the sides of this gallery the eggs (about fifty) are laid in notches, and, as soon as hatched, the young larvæ proceed to mine slender passages for themselves, working outward from the original one, and enlarging them as they proceed. Each larva avoids, if possible eating into its neighbour's burrow, and the tracks of some species of bark-beetles make very regular patterns indeed. The bark is thus so loosened from the wood that it dies and comes away in large pieces, enfeebling the tree and subjecting it to the attacks of large borers.

Tomicus calligraphus, the "elegant writing" bark-beetle, is slightly larger, but is very similar in appearance to the last species. It is of a chestnut brown color, and is sparsely clothed with yellowish hairs; the elytra being lined with coarse punctures. The burrow formed by the female in which to deposit her eggs is from six to twelve inches long, but more irregular than is that of the last species. The tracks of the larvæ are more tortuous and larger, and the perforations in the bark are also bigger.

Tomicus pini, the pine bark-beetle, is smaller, being barely one-eighth of an inch long. It is probably the most abundant of all our pine bark-beetles, but as its ravages are said to be confined to old trees, it is not so serious a foe as the preceding varieties. The tracks made by the larvæ differ from those of other species, and look as if several eggs had been placed at the bottom of a hole bored in the bark, and the young had eaten outward in diverging directions. The burrows are about two inches long, and are eaten partly in the outer surface of the wood and partly in the bark. The beetle is dark brown, the tips of the elytra bearing each four teeth.

Dendroctonus terebrans is the largest of our bark-beetles, measuring four-sixteenths to five-sixteenths of an inch in length and found in some abundance. The head is much larger, proportionately, than in the other species, and is plainly visible; the thorax is shorter, and the elytra bluntly rounded at the tips, not excavated, nor toothed. Its color is dark reddish or foxy. It perforates larger holes in the bark, and mines curving galleries in all directions, confined chiefly to the inner bark-layers, and only slightly grooving the surface of the wood.

Hylurgops pinifex is a smaller and darker beetle, about three-sixteenths of an inch, or slightly more, in length, and of a dark reddish brown color; very abundant about lumber yards and pine groves.

The last species which I shall mention resembles the foregoing, but is slightly slenderer and varies much in size; being from two-sixteenths to four-

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sixteenths of an inch long. Its color is black, and in this and other respects it appears to correspond with the beetle given as *Hylastes carbonarius* by Dr. Fitch, and for the present I have named it so, not knowing the synonym which it now bears. The specimens of it exhibited were taken, on the 24th May last, at Wright's Island, in the Gatineau.

The two cases upon the table contain specimens of the beetles described, as well as others, in all, forty species of Ottawa coleoptera injurious to the pine, viz.:—

SCARABÆIDÆ.

3426 Dichelonycha albicollis, *Burm.*

BUPRESTIDÆ.

3683 Chalcophora virginiensis, *Drury.*
3684 " liberta, *Germ.*
3686 " fortis, *Lec.*
3696 Dicerca tenebrosa, *Kirby.*
3715 Buprestis maculiventris, *Say.*
3718 " consularis, *Gory.*
3721 " striata, *Fabr.*
3735 Melanophila fulvoguttata, *Harris.*
3768 Chrysobothris Harrisii, *Hentz.*

CERAMBYCIDÆ.

4915 Orthosoma cylindricus, *Fabr.*
4924 Tragosoma Harrisii, *Lec.*
4927 Asemum mœstum, *Hald.*
4928 " atrum, *Mann.*
4932 Criocephalus agrestis, *Kirby.*
4960 Callidum antennatum, *Newm.*
4961 " janthinum, *Lec.*
5153 Atimia confusa, *Say.*
5165 Rhagium lineatum, *Oliv.*
5323 Monohammus scutellatus, *Say.*
5325 " confusor, *Kirby.*
5326 Monohammus marmoratus, *Rand.*
" dentator, *Fabr.*

CHRYSOMELIDÆ.

5609 Cryptocephalus notatus, *Fabr.*
5676 Glyptoscelis hirtus, *Oliv.*
5740 Chrysomela philadelphica, *Linn.*

CURCULIONIDÆ.

8853 Scythropus elegans, *Couper.*
8928 Hylobius pales, *Herbst.*
8931 " stupidus, *Sch.*
8934 Pissodes strobi, *Peck.*
8937 " affinis, *Rand.*
8990 Dorytomus mucidus, *Say*

SCOLYTIDÆ.

9501 Pityophthorus materiarius, *Fitch.*
9528 " sparsus, *Lec.*
9546 Xyleborus xylographus, *Say.*
9562 Tomicus calligraphus, *Germ.*
9568 " pini, *Say.*
—— " semicastaneus, *Mann.*
9619 Dendroctonus terebrans, *Lec.*
9642 Hylurgops pinifex, *Fitch.*
—— Hylastes carbonarius, *Fitch.*

NOTE.—The numbers in the above list are from Crotch's (revised) Check-List of North American Coleoptera.

SIXTH SOIREE.

FRIDAY, 11th February, 1881: J. A. Grant, Esq., M.D., F.R.C.S., F.G.S. delivered a lecture upon "The Brain, the Gymnasium of the Mind," which might be considered a continuation of his lecture upon "The Brain" in last year's course, and was in like manner illustrated by the dissection of a human brain, as well as by charts and a series of skulls. He contended that the human countenance, which derives its expression from the influence of the brain, was a much

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more scientific index of a man's mental qualifications than the shape of his skull, and detailed the physical composition of the brain. He condemned in unsparing language the cramming process so prevalent in our public system of education, and earnestly advocated the bestowal of more attention upon the physical health of the young, in order that their brains might first be properly developed. The lecturer instanced several men of commanding intellect who had in their youth been more noted for athletic skill than for mental attainments.

"NOTES ON TWO SPECIES AND ONE GENUS OF FOSSILS FROM THE TRENTON LIMESTONE, OTTAWA." MR. W. R. BILLINGS.

1. *Lichenocrinus crateriformis*, Hall.—I have to record the discovery of this species in the Trenton Limestone at Rochesterville. Previous to this no species of *Lichenocrinus* has been observed in the Trenton Limestone, being confined to the Utica Slate and lower part of the Hudson River Group. There are four recorded species of this genus, and *L. crateriformis* is the lowest in time, it alone having been found so low as the Utica Slate, while the others belong to the Hudson River Group. My specimens are imperfect, are two in number, and were discovered associated with *Lixerophycus Ottawaensis*, *Paleophycus obscurus*, *Pasceolus globosus*, *Chætitis petropolitanus*, *C. discoideus*, *Ptylodictya acuta*, *Murchisonia bellicincta*, *M. gracilis*, *Orthis testudinaria*, *O. subquadrata*, *Leptena sericea* and *Heterocrinus Canadensis*.

2. *Pleurocystites filitextus*, Bill.—This species was founded upon an imperfect specimen which had lost a part of the base containing the greater portion of the basal rhomb. The condition of the specimen rendered it doubtful whether another specimen, figured on the same plate* belonged to the species under consideration or to *P. Elegans*. During the past summer I was fortunate enough to obtain a suite of specimens of *P. filitextus*, ranging in size from 0·5 inch to 1·5 inches in length of body (head of most authors); and a careful examination has caused me to form the opinion that the figure originally taken as doubtful belongs to this species. The specimens in my possession appear to show that the peculiarities of the upper rhombs, the size of the irregular plates on the ventral side, and the general form of the body, afford excellent specific means of distinction, but the basal rhomb in some specimens is hardly distinguishable from *P. Elegans*, while in others it presents the rounded corners of the typical specimen.

3. *Genus Caraboerinus*, Bill.—I give a note on this genus principally to point out how the freshest beginner in the study of a scientific subject may be of use in collecting facts to aid a scientific authority in generalization. The genus I am considering was founded in 1856, and three species described. A specimen of one of these species alone exhibited the azygos plates, the peculiarities of which separated the genus from *Cyathocrinus*. No other species have since been described; nor has the discovery of new specimens been recorded. In the "Proceedings of the Academy of Natural Sciences, Philadelphia," Nov. 4, 1879, Mr. Charles Wachsmuth, the highest American authority on the Palæozoic Crinoids, stated the opinion† that "*Caraboerinus* is founded upon a malformed or recuperated *Cyathocrinus*." The anomalous form of the azygos plates was dwelt on

* Fig. 2, Decade 3, G. S. C.

† Revision of the Inadocrinoidea, page 144.

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in detail, and the distinguished author stated the view that they were portions of a single plate "which was accidentally broken during the life of the animal, and afterwards recuperated, leaving marks of fracture which Billings took to be sutures between the plates." During last Spring I collected a small specimen of a species of this genus, and shortly after was favored with a view of another specimen (likely of a new species), which Dr. Grant had sent him from Belleville, in company with specimens of a new species of *Porocrinus*, for description. Both the specimens had the identical arrangement of azygos plates shown in the generic diagram.* I communicated the result of my examination to Mr. Wachsmuth, and he at once stated that he would abandon his view.

SEVENTH SOIREE.

FRIDAY, 25TH FEBRUARY, 1881.—"LILIACEÆ," BY LIEUT.-COL. WM. WHITE.

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I propose to devote our time this evening to the genus *Lilium*, from which the order *Liliaceæ* derives its name. This genus includes plants with scaly bulbs, from which arise leafy stems, bearing at the top from one to many large showy flowers. The stem leaves are alternate or whorled, short and usually sessile, except the two eastern forms, which have heart-shaped leaves and long petioles. The great characteristic of the Tiger Group, and one by which they are easily propagated, is the constant presence in the axils of each leaf of one to three bulblets, shiny and black, about the size of peas, which, in the Autumn, fall, or are gathered, and in three years' time will, if cultivated, produce flowering bulbs.

The flower of the lily consists of six petal-like divisions or sepals, either distinct or partly united below, and spreading or recurved above, forming a funnel-shaped or bell-shaped perianth. Each of the divisions has a honey-bearing furrow at the base.

The genus *Lilium* has been sub-divided by Professor Baker, of Kew, into five sub-genera; each being perfectly distinct from the others, so that any person who will take the trouble to master the characters of these five sub-genera will have no difficulty in referring to its proper position any specimen which may be under consideration.

According to Professor Baker's classification, the first sub-genus is—

Cardiocrinum.—The perianth is funnel-shaped, with oblanceolate segments, falcate only at the apex. Leaves large, rotundate-cordate, very different to the lanceolate or linear leaves of all the others, with true petioles sometimes as long as the leaves. The only two lilies at present known belonging to this sub-genus are the heart-shaped leaved (*L. cordifolium*) lily from Japan, and the Giant Lily (*L. giganteum*) from the Himalayas. This sub-genus is at the same time the finest and most distinct of all true lilies, being completely different from all the rest in possessing long petioles, and in the shape and veining of its leaves.

The second sub-genus has been named—

Eulirion.—Perianth funnel-shaped, with oblanceolate segments, falcate only at the apex, stamens slightly curved parallel with the style, lines linear or lance-shaped, sessile or nearly so, flowers fragrant, often white, never red. Of this sub-genus there are twelve species known to the Old World, of which the one best

* Decade 4, G. S. C.

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known is the White Lily of our gardens (*L. Candidum*). The white Japan Lily (*L. longiflorum*), which also belongs to this sub-genus, is now frequently met with in cultivation, but is rather tender in our severe climate.

The third sub-genus is—

Archelirion.—Perianth open, funnel-shaped, with deeply spreading segments, which are broadest below the middle ; stamens diverging from the curved style. Leaves sessile, as in the Tiger Lily, and with short stalks, as in *Auratum* and *Speciosum*. There are only four species in this sub-genus, but three of the four, the Tiger Lily (*L. Tigrinum*), the Golden Lily (*L. auratum*), and the red-spotted Japan Lily (*L. speciosum*), originally introduced as *L. lancifolium*, are now to be met with in most large collections.

The next, the fourth sub-genus, is—

Isolirion, erect-flowered lilies.—Perianth broadly funnel-shaped, standing erect for a considerable time, usually brilliant red or yellow, segments oblong, lance-shaped, or spathulate, stamens diverging on every side from the erect style. Leaves in whorls, as in *L. Philadelphicum*, or scattered, as in *L. Catesbœi*. *Lilium Philadelphicum* is common in open copses throughout Western Canada and the Northern United States, stretching westward to the Rocky Mountains, and southward along the Alleghanies to North Carolina. It was introduced to England in 1754. *Lilium Catesbœi* is also an American lily. It is found from Carolina to Georgia, taking, in the South, the place occupied by *L. Philadelphicum* in the North. This lily does not usually succeed well under cultivation, and is therefore rarely met with in gardens.

The fifth and last sub-genus is the

Martagon, or Turks-cap Lilies.—Flowers in racemes, nodding, dotted usually of a brilliant red or orange colour ; perianth broadly campanulate ; segments lance-shaped, deeply falcate, grooves deep ; stamens diverging on all sides from the curved style. In this sub-genus we have twenty-three species, including many superb forms:—*Excelsum*, with its tall, peculiarly graceful, nankeen-coloured flowers, so exquisitely scented ; *Canadense*, with its beautiful nodding, bells, one of the first introduced to European gardens from this continent, figured in Parkinson's Paradisus in 1629 ; the purple *Martagon*, which puts forth its flowers in the early summer months ; and several others not less handsome, but not so generally known.

The genus *Lilium* (the name lily is said to be derived from a Celtic word "li," signifying whiteness, the lily having been long considered an emblem of purity), as you will already have observed, embraces several of the most remarkable species in the whole vegetable kingdom, distinguished by elegance, size and variety of colour ; ranging in size from the dwarf forms of *Umbellatum*, with flowers only six or eight inches from the ground, to the magnificent Giant Lily of the Himalayas, bearing its crown of blossoms eight or nine feet high. Lilies are among the oldest and best known flowers of our gardens ; they are also among the most recent introductions of plant collectors.

The White Lily (*L. Canodidum*) is said to be a native of the eastern islands of the Mediterranean. It has been cultivated in England since the days of John Gerarde, a surgeon and botanist, who was born in Cheshire in 1547, and died in 1607. Yet, with this exception, lilies may be said to be of recent introduction.

In 1774 Linnæus found only nine species to describe, of which five belonged to the Old World exclusively ; three, *Superbum*, *Canadense* and *Philadelphicum*, to North America ; and one, *Kamschatkense*, said to be common to both continents. This latter, however, appears to have been re-named, as I am unable to identify it in more recent classifications. Shortly after the time of Linnæus, the Pyrenean (*L. Pyrenaicum*), the Orange (*L. Croceum*), and Catesby's Lily (*L. Catesbœi*), were added to the list.

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Towards the close of the last century, Thunberg published a work on the flora of Japan, and introduced to the world some of the wonderful species from that country. About 1823 Dr. Van Siebold, of Wurzberg, visited Japan in the capacity of physician to the Dutch Embassy, and up to his death, in 1866, never ceased to collect and to encourage the collection of these plants for introduction into Europe.

In 1804, the now well-known Tiger Lily (*L. Tigrinum*) was brought from Japan by Captain Kirkpatrick. The attractiveness of its brilliant red flowers, joined to the hardiness of the plant, which enables it to withstand the extreme cold of Canada, and to flourish in the moist climate of Britain equally well, has rendered it for many years past one of the best known and most generally cultivated of all lilies.

It is only quite recently, however, that the most magnificent lilies of Japan have become generally known, the splendid Golden Lily (*L. auratum*) having only come into general cultivation within the last ten or twelve years. Lilies are supposed to have been cultivated in Japan for centuries with as much care and attention as have been given to the production of tulips and hyacinths in Holland.

It is somewhat singular, considering how much attention has been given of late years to the introduction and cultivation of lilies, that the origin of two of the most beautiful species in cultivation is unknown.

The Nankeen Lily (*L. Excelsum*), a beautiful sweet-scented lily of the *Martagon* sub-genus, closely resembling in form and general appearance the well-known White Lily (*L. Candidum*), is one of them; and Brown's Lily (*L. Brownii*), a lily of the *longiforum* type, having the outside of the petals a deep chocolate colour, is the other. *L. Excelsum* (or *Testaceum*, as it is frequently called,) is unknown in a wild state, and is supposed to be a hybrid between the common White Lily (*L. Candidum*) and scarlet Turk's-cap (*L. Chalcedonicum*. *L. Brownii* is believed to have been introduced from China or Japan, but nothing certain seems to be known either as to the place from whence it came or the person who first brought it into notice.

* * * * * * *

On the same evening an instructive paper was read by Mr. J. Martin "On the study of Botany." He described the different parts of plants, their functions in the economy of nature, and the simplicity of the method of classification that had been adopted by botanists; and urged the claims of the science of botany on the younger members of the Club in an able and interesting manner.

EIGHTH SOIREE.

FRIDAY, 11th March, 1881: On this evening a lecture was delivered by Prof. J. Macoun, F.L.S., Botanist to the Canadian Government, on "The Capabilities of the Prairie Lands of the Great North-West, as shown by their Fauna and Flora." The lecturer first explained the laws of geographical distribution, by which, for example, the geologist can state the horizon to which certain fossils must belong, and the botanist determine, by the inspection of plants from a certain locality, the character of the soil and of the climate, and the consequent

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adaptability of the district for the growth of certain varieties of cultivated plants. He asserted that this botanical test was the only true criterion by which the agricultural status of any district should be judged. In the North-West every species of plant was found to have its particular *habitat* as regards soil and moisture. This fact had been realized by the members of the Geological Survey, for in the last report Prof. Bell had stated that "the information derived from a study of the distribution of trees and shrubs, and of the flora generally in any district, affords one of the most certain means of judging the climate for agricultural purposes." Such a test had been applied by him in his explorations of the Peace River country during 1872 and 1875. Many excursions off the direct line of travel were made in descending the river, and all the species of plants noted, with the exception of three, were similar to those of Ontario, whence he deduced that the summer climate of the Peace River region was similar to that of Ontario, aud that the same cereals which came to perfection in the latter place would do so in the former. Actual cultivation had since fully proved the truth of that deduction. The previous season he had visited the Cypress Hills region, and received unfavourable impressions of it on account of the number of Rocky Mountain species of plants growing there. He at once concluded that the district would not ripen cereals, and further observation justified that conclusion. With reference to the large tracts of alkaline lands, so generally denounced as sterile and incapable of cultivation, he explained that their apparent aridity and want of vegetation was nearly always due to causes which cultivation of the soil would remove. Holland, principally an old sea-bottom, was noted for its fertility, and salt marshes when reclaimed from the sea, as in the Basin of Minas, were known to form the best pastures in the world, although salt lands were said to be regions of sterility. Yet he knew that on the alkaline soil, even where the cactus and sage-bush grew, the grass was always cropped short by the cattle, and from his observations he believed them to be some of the best pasture lands in the world. On these soils also seaside plants, such as the cabbage, grew in great luxuriance. Passing on, the lecturer alluded to the warm and cold soils of the vast interior, and stated that nearly all the prairie uplands were covered with a warm soil, and, from the nature of the flora, he was positive that frosts would never do serious injury in these localities. The river silts and clays produced plants that were boreal in their tendency, as contrasted with the southern plants found growing on the uplands; and in the river valley crops invariably suffered from frost. The farmers were rapidly learning this fact, and, avoiding the loamy lands of the

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valleys, preferred the dry exposed prairies formerly neglected, but now found to be incomparably superior, for the growth of cereals, to the lower but cooler lands. It was found that on the warmer soil of the prairies the crops ripened three weeks earlier than in the river valleys and the colder lands of Manitoba. Hence, the second prairie steppe, beginning one hundred miles west of Winnipeg and extending to the Saskatchewan, would be found far superior to Manitoba for the growth of cereals, because there a certainty of at all times ripening the crops was assured. Although summer frosts might occassionally make their appearance in the valleys, there were none, or scarcely any, on the level plateaux. Last year crops put in after the 15th June had been injured by frost, but only severely in the valleys. With regard to rain, little fell before the crops were planted, but after that there was an ample fall to secure their full growth. The lecturer then enunciated an important botanical law, as accounting for the well-known heavy crops of grain secured so far north. This was the law of wonderfully increased reproduction as plants approached their outer, or northern, limit. Hence, the cereals grown in the districts alluded to, so near the extreme northern limit, were found to be more prolific than those grown anywhere else. Ordinarily, on an ear of wheat grown in Ontario each fascicle contained but two grains. In Winnipeg they averaged two and a-half, at Prince Albert four, and at Edmonton nearly five. When it was taken into account that the heads also increased in length, it was not difficult to understand that the same number of stalks that would produce fifteen to twenty bushels to the acre in Ontario would yield twenty-five bushels at Winnipeg, and from thirty to forty bushels farther north. As regarded the grasses found in various parts of the country, the same species grew under the eastern base of the Rocky Mountains as were found farther east, and commonly supposed to be inferior in quality. The only difference was, that on the dry plains of the south hardly any grasses produced large crops of seeds, so that the fodder afforded by the natural drying up of the grasses was richer in nutriment, nearly equalling first-class hay. The "buffalo grass," incorrectly named "wild oats," did not, as often stated, harm either sheep, horses or cattle. Referring to Capt. Palliser's assertion, that the country near the Red Deer Lakes was barren, he explained that this was due to buffalo and deer having eaten the district bare. In 1879 the same tract of land was covered with waving grass, but not a quadruped was to be seen there. The land which had supported millions of buffaloes could assuredly not be called barren, but could feed cattle for the English market, and also supply the wheat, flax and hemp so largely imported from

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Russia by the Mother Country, for its climate was similar to that of Southern Russia, which supplied all these commodities. While considering the stock-raising capabilities of the country, he referred to the popular belief that cattle fatten on the grazing lands of Texas and warm districts of the South, characterizing it as a fallacy, as shown by the custom amongst graziers of driving their herds northward to fatten. This was also in obedience to a well-known law which provided that the farther north animals were found the greater was their capacity for putting on fat. On this ground he was convinced of the great advantages possessed by the North-West as a cattle-raising country. A few years ago Major Butler had styled this country the Great Lone Land, but it was being rapidly settled, and was destined, in the near future, to be a great grain-producing and stock-raising country, sustaining a large population and exporting an immense surplus of grain and meat.

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FLORA OTTAWAENSIS.

ADDITIONS TO LIST OF 1879-1880.

NYMPHÆACEÆ.

Nuphar luteum, Smith.

SARRACENIACEÆ.

Sarracenia purpurea, L.
——————v. hiterophylla.

ROSACEÆ.

Amelanchier Canadensis, T. and G.
——————-v. Botryapium, Gray.

CRASSULACEÆ.

Sedum Telephium, L.

HAMAMELACEÆ.

Hamamelis Virginica, L.

CUCURBITACEÆ.

BETULACEÆ.

Betula lenta, L.
Alnus viridis, D. C.

SALICACEÆ.

Salix myrtilloides, L.

NAIADACEÆ.

Zannichellia palustris, Micheli.
Potamogeton Vaseyi, Robbins.

ALISMACEÆ.

Schenchzeria palustris, L.
Sagittaria graminea, Michx.

ORCHIDACEÆ.

Habenaria fimbriata, R. Br.
——————-virescens, Spreng.

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Errata—Flora Ottawaensis, page 41.

For "Nuphar luteum, Smith" *read* "Nuphar luteum, Smith. *var.*——— ?"

For "Sarracenia purpurea, L.
———*v.* hiterophylla" } *read* "S. purpurea, L. *var.* heterophylla, Torr."

Omit "ROSACEÆ. Amelanchier Canadensis, T. & G.
———*v.* Botryapium. Gray." }

For "Sedum Telephium, L" *read* "*Sedum Telephium*, L."

For "Senecia vulgaris, L." *read* "*Senecio vulgaris*, L."

For "Pyrola rotundifolia, L.
———*v.* Uliginosa, G." } *read* "P. rotundifolia, L., *v.* uliginosa, G."

For "LABIATEÆ" *read* "LABIATÆ."

For "Lycopus Europæus, L.
———*v.* integrifolia, G." } *read* "L. Europæus, L., *var.* integrifolius, G."

For "*Nicaudra*" *read* "*Nicandra*."

For "Urtica Dioica, L." *read* "*Urtica dioica*, L."

For "Schenchzeria" *read* "Scheuchzeria."

For "Carex irrigna" *read* "C. irrigua."

For "Poa Scrotina" *read* "Poa serotina."

For "Asplenium Filix-Fœmina.
———*v.* Michauxii, Mettenius." } *read* "A. Filix-fœmina, Bernh., *v.* Michauxii, Mettenius."

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FLORA OTTAWAENSIS.

ADDITIONS TO LIST OF 1879-1880.

NYMPHÆACEÆ.

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Sarracenia purpurea, L.
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——————v. Botryapium, Gray.

CRASSULACEÆ.

Sedum Telephium, L.

HAMAMELACEÆ.

Hamamelis Virginica, L.

CUCURBITACEÆ.

Sicyos angulatus, L.

COMPOSITÆ.

Aster æstivus, Ait.
Senecia vulgaris, L.
Cirsium muticum, Michx.
Onopordon Acanthium, L.

ERICACEÆ.

Pyrola rotundifolia, L.
———v. Uliginosa, G.

SCROPHULARIACEÆ.

Linaria vulgaris, Mill.

LABIATEÆ.

Lycopus Europæus, L.
————v. integrifolia, G.

SOLANACEÆ.

Nicaudra Physaloides. Gærtn.

CHENOPODIACEÆ.

Chenopodium Ambrosioides, L.

URTICACEÆ.

Urtica Dioica, L.

BETULACEÆ.

Betula lenta, L.
Alnus viridis, D. C.

SALICACEÆ.

Salix myrtilloides, L.

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Schenchzeria palustris, L.
Sagittaria graminea, Michx.

ORCHIDACEÆ.

Habenaria fimbriata, R. Br.
————virescens, Spreng.

CYPERACEÆ.

Carex Backii, Boott.
———limosa, L.
———irrigna, Smith.
———arctata, Boott.
———filiformis, L.
———longirostris, Torr.

GRAMINEÆ.

Vilfa vaginæflora, Torr.
Agrostis perennans, Tuckerm.
Muhlenbergia sylvatica, T. and G.
Poa cæsia, Smith.
——Scrotina, Ehrhart.
Festuca nutans, Willd.
Triticum caninum, L.
Gymnostichum Hystrix, Schreb.
Avena striata, Michx.
Millium effusum, L.
Panicum capillare, L.

FILICES.

Asplenium Filix-Fœmina.
——————v. Michauxii, Mettenius.

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DESCRIPTION OF A NEW SPECIES OF POROCRINUS,

FROM THE TRENTON LIMESTONE.

With remarks on the Genus, by JAMES GRANT, M.D.; F.R.C.S.; F.G.S., etc.

GENUS POROCRINUS, BILLINGS.

Porocrinus, Billings, Report Geological Survey of Canada, 1856.
Porocrinus, Billings, Decade 3, Geological Survey of Canada, 1859.
Porocrinus, Meek and Worthen, Proc. Acad. Nat. Sci. Phila., 1865.

This genus was founded on one species from the Trenton Limestone at Ottawa :—*P. Conicus*, the type of the genus. In the Proceedings of the Academy of Natural Sciences, Philadelphia, 1865, Meek and Worthen described *P. Pentagonus*, from the Trenton Limestone, and *P. Crassus* from the Hudson River Group, both from Illinois.

We have now a new species from the Trenton Limestone at Belleville, discovered by Mr. W. R. Smith, of that city.

The specimens examined exhibit some new features, which do not, however, in any way invalidate the original description of the genus.

In the original description of *P. Conicus* the pores are spoken of as "fine elongated parallel slits which appear to penetrate through the plates." In the descriptions of *P. Pentagonus* and *P. Crassus* the divisions between the pores are mentioned as "plates." A careful examination of the new specimens, about to be described, show that the pores do not open on the outside surface, each pair of plates being externally arched, making the hydrospires appear like one side of a collection of flat black tubes placed side by side, while one specimen (Fig. 2) has on several of the hydrospires a thin investing membrane, as in *Paleocystitis* and *Comarocystitis*. E. Billings states that in these last named genera it is probable that the pores are not visible externally unless the surface is worn. I fancy that all the species of *Porocrinus* already founded were described from worn specimens. The membrane mentioned covers each hydrospire completely and obliterates the sutures of the plates where it covers them.

I cannot find that the vault plates or the structure of the arms have been before observed. Meek and Worthen, in describing *P. Crassus*, state that the vault seems to consist of three or four comparatively large plates." The vault and arms described hereinafter are much the same as in *Cyathocrinus* (as revised by Wachsmuth.)

POROCRINUS, SMITHI, Sp. Nov.

Basals.—Five, pentagonal, wider than high, of nearly equal size.

Subradials.—Five ; three hexagonal and two heptagonal.

Radials.—One by five, as long as the sub-radials, while four of them are wider, hexagonal, excepting that their apices are notched about one-fifth the length of the plates to form a part of the passages of the arms, and in two of them the angle adjacent to the proboscis is wanting. Articulating facets about one-quarter the width of the radials, and extending downwards nearly to their centres.

Brachials.—One by five, as wide as arm joints, but at their points of greatest length nearly three times as long as an arm joint.

Azygos plates two, the lower one quadrangular, resting on the two heptagonal plates ; and the other, pentagonal, supported on one heptagonal and the lower azygos plate.

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Cup, obconical of a sub-pentagonal outline viewed from below; at the junction with the column the diameter is a little less than one-half the greatest diameter. Surface of cup ornamented with radiating costæ, two lines of which, one each at the centre of the radials and sub-radials, form zones around the cup; between these two lines others pass at right angles across the sutures of the plates, forming a series of triangles; below the lower zone, from the centre of each sub-radial, a single costa passes downward to the basals, where it is continued, one-half on each plate (without bifurcation), and expands into a slightly elevated ring, encircling the base of the cup.

Each rhomb, or hydrospire, occupies an angle of three separate plates; they are trilobate, and in shape bear some resemblance to a very stout letter Y, with pointed terminations, having three re-entering and nine salient angles.

The angles of the inter-costal triangles to the edges of the hydrospires are striated in lines parallel to the lines of the spiracles. These striations are not even grooves, but appear to be formed of elongated, shallow pits or punctures placed with their ends in contact.

Arms simple, apparently long, one specimen having a portion of an arm, once and a half the length of the cup, but slightly reduced in diameter, and without branching (Fig. 3). The same specimen shows that the grooves of the arms were bordered by erect rows of plates about two-thirds the width and somewhat less than one-half the depth of the arm joints.

Vault composed of five large plates separated by broad grooves continuous with the upper grooves of the arms and radiating from the centre of the apex; four of these fit in between the re-entering angles of the radial plates, and the fifth (situated immediately over the proboscis) is excavated in the same manner as the radials on either side of the upper azygos plate. The radiating grooves appear to be covered with double rows of small plates interlocking and alternating with one another. Only one specimen has been examined showing the summit structure, and in it the arrangement of plates at apex could not be satisfactorily made out. A small tube or circular opening was observed at the lower end of one of the grooves, immediately above the arm notches (Figs. 1 and 6).

The proboscis appears to have been short and made up of lancet-shaped imbricating plates, but as the area immediately around it has none of the plates preserved in the only specimen possessing this organ, it cannot be spoken of with certainty.

Column round, with a small pentagonal canal. In the specimens examined only small portions of the columns are preserved, and these taper to such a degree that the diameter is reduced from one-quarter inch to one-fourteenth inch in a proximal fragment of column three-eighths of an inch long; and in a similar portion five-sixteenths of an inch long from one-quarter inch to one-ninth inch. The separated disks of column appear flat and smooth, and show five indistinct petaloid depressions on the under side which correspond with similar elevations on the upper side, and which terminate outward on the line of sutures of basals; these disks do not reach the external surface of the column, there being an investing sheath or covering encircled by wavy lines at distances from each other equal to the thicknesses of the disks.

This species differs from *P. Conicus* in having prominent costæ instead of a smooth surface; in having wide short basals; in having the external shape of the hydrospires trilobate instead of being spherical triangles; as also in its greater size. From *P. Crassus* the chief points of difference are that the sutures are not prominent, nor does the base overhang the column, while the hydrospires are trilobate throughout. *P. Pentagonus* is the species most nearly related to the one now under consideration. It differs in the shape of the body which (in *P. pentagonus)* is obovoid and broadest on a line drawn through the centre of the sub-radials; it also has only a portion of the hydrospires trilobate: otherwise it appears to agree very closely with our new species.

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DESCRIPTION OF PLATE.

Fig. 1. Side view of a specimen of *Porocrinus Smithi*, without arms or column.

Fig. 2. An imperfect specimen, having a membrane covering two of the hydrospires.

Fig. 3. Flattened specimen, with portions of arms and column.

Figs. 4 and 5. Sections of column showing size of central canal, &c.

Fig. 6. Summit structure of specimen shown in Fig. 1.

Fig. 7. One of the sub-radial plates enlarged.

Fig. 8. Diagram.

Fig. 9. Specimen of *Agelacrinites Dicksoni* from the Cabinet of Dr. Grant.

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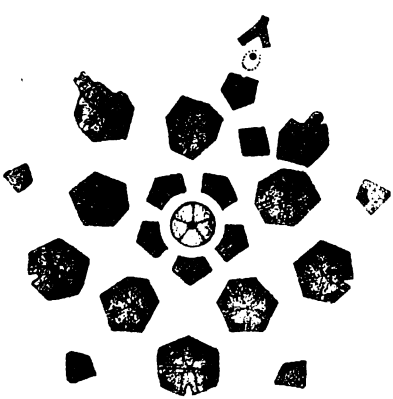

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FIELD-NATURALISTS' CLUB.

TRANSACTIONS NO. 3.

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Committee:

W. D. LESUEUR. | W. P. ANDERSON.

P. B. SYMES. | L. A. HAMILTON.

H. M. AMI.

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LIST OF MEMBERS.

Ami, H. M.
Ami, Samuel F.
Anderson, W. P., *C.E.*
Anderson, Mrs. W. P.
Armstrong, Rev. Wm., *M.A.*

Baptie, Prof. Geo., *M.A.*
Bell, E. B.
Bell, Ernest S.
Bennetts, F. K.
Billings, B.
Billings, W. R.
Boardman, Wm. F.
Bradley, Inglis W.
Bristow, A. A.
Bristow, Mrs. A. A.
Burgess, T. J. W., *M.D.*
Butterworth, C. A.

Cameron, Rev. A. A.
Campbell, William
Chamberlin, Mrs.
Chisholm, A.
Chrysler, F. H., *B.A.*
Clark, T. McLeod
Cousens, W. C.
Curtis, Smith

Davy, R. A., *C.E.*
Dixon, F. A.

Ewart, D.

Fleming, Sandford, *C.E.*, *C.M.G.*, *M.R.S.C.*
Fletcher, James
Fletcher, Mrs. J.
Fortescue, L.
Fortescue, Mrs. L.
Fraser, A.

Geddes, W. H.
Gemmill, J. A.
Gisborne, Francis H.
Grant, George W.
Grant, J. A., *M.D.*, *F.R.C.S.*, *F.G.S.*, *M.R.S.C.*
Gray, H. H. O.
Griffin, W. H.
Grignard, A.

Hale, J.
Hamilton, L.A., *D.L.S.*
Hanham, A. W.
Hannington, Rev. E. A. W.
Hardie, John
Hardie, T. Melville
Harrington, W. Hague
Harrington, Mrs. W. H.
Harris, W. Dale
Hector, Thos.
Hodgins, John

Jarvis, F. A.
Johnson, E. V., *C.E.*

Kemp, Rev. A. F., *M.A.*, *LL.D.*

Latchford, F. R.
LeSueur, W. D., *B.A.*
LeSueur, Mrs. W. D.
Lett, F. P. Austin

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LIST OF MEMBERS.—*(Continued.)*

Lindsay, A.
Lowe, John

MacLaughlin, T. J.
Martin, Joseph
Matheson, D.
McLaughlin, S.
McLean, J. D.
Monk, J. B.
Morris, R.
Mowat, J.

Newby, Frank
Nicholson, M. Vernon

Patton, Rev. H. B.
Perley, Henry F.
Pettegrew, W. S.
Plunkett, James
Poirier, P. S.

Rauscher, Rudolf
Ripley, C. J.
Rogers, C. C.

Scott, W. L.
Selwyn, A. R. C., *F.R.S.*, *LL.D.*, *M.R.S.C.*
Shannon, S. Leonard
Sinclair, Miss E. J.
Small, A.
Small, Beaumont, *M.D.*
Small, H. B.
Sowter, E. T. W.
Steers, C. J.
Stewart, J. C.
Symes, Miss
Symes, P. B., *A.K.C.*

Thorburn, John, *M.A.*, *LL.D.*
Todd, A. H.
Tomlinson, J. B.
Tyrrell, J. B., *B.A.*

Watters, Henry
Watts, J. W. H., *A.C.A.*
White, Geo. R.
White, *Lt. Col.* Wm.
Whiteaves, J. F., *F.G.S.*, *M.R.S.C.*
Whyte, G. C.
Whyte, Miss Isabella
Whyte, J. G.
Whyte, R. B.
Wickstead, R. J., *B.C.L.*, *LL.D.*
Wiggins, E. Stone, *LL.D.*
Wiggins, Mrs. E. S.
Wood, H. O., *P.L.S.*
Wright, Miss
Wright, W. R.

Young, James.

CORRESPONDING MEMBERS.

Hill, A. J., *C.E.*, "Camp D" C. P. R., British Columbia.

Macoun, Prof. John, *F.L.S.*, *M.R.S.C.*, Government Botanist, Belleville, Ont.

Saunders, Wm., *M.R.S.C.*, President Ent. Soc. of Ontario, London, Ont.

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ANNUAL REPORT OF THE COUNCIL.

To the Members of the Ottawa Field-Naturalists' Club:

The Council elected by you on the 15th of March, 1881, in submitting their report upon the work performed during the year just closed, can with much satisfaction congratulate you upon the progress which the Club has continued to make in the investigation of the natural history of the locality. Twenty Council meetings were held, at the first of which three standing committees were appointed to have charge respectively of printing, excursions and soirees. Much work was accomplished by these permanent committees, as well as by temporary ones appointed as occasion required. The Council made it their first duty to carefully and earnestly consider what means might be adopted to stimulate the interest of the members in the objects of the Club, and to secure an increase in the work performed by them. These deliberations resulted in the appointment of leaders in the several branches of natural history and in the offer of prizes. The duties assigned to the leaders were :—To render any assistance in their power to the members engaged in collecting or studying in their respective branches; to bring together for mutual aid and encouragement the members interested in the same subject; to organize and direct working parties; to keep notes of work done and to report to the Council at the close of the season. Valuable reports were received from the several sections, proving the value of the system, and indicating that much work might be accomplished by its continuance. For the best collection of specimens in each branch a prize was offered as an incentive to collectors, and as an inducement to others to study the

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natural sciences. Competition was open to every member of the Club, and the collections were to be made personally in this locality during the season, and to be submitted, properly arranged and named, for examination by 31st December, 1881. Special prizes were also offered by the President to members making the largest additions to the lists of plants and shells already published in the Transactions of the Club. Of the latter, that for additions to the lists of plants was awarded to Mr. H. M. Ami, and that for additions to the lists of shells to Mr. Latchford. The Club prize for the best botanical collection was awarded to Mr. T. Melville Hardie. A fine collection of shells was exhibited by Mr. F. Latchford, for which, however, no prize was given, as he had secured the President's prize for additions to lists of shells, and the Committee did not wish to establish the precedent of allowing a member to obtain more than one prize for the same collection. No collections were received in the other branches.

At the beginning of the year there were upon the rolls the names of 102 members, and 30 new members were elected during the year. Several have, however, left the city, and a few have forfeited their membership through non-payment of arrears, so that the number now stands at 115. The Club is thus stronger in members, and especially in active workers, than at any previous time. The list of corresponding members remains unchanged. Mr. A. J. Hill has continued to send valuable collections of plants and insects from British Columbia.

Four very pleasant and well attended excursions were held during the summer. The first was to Chelsea on the 26th of May, the halting place being Gilmour's Grove, upon the bank of the Gatineau. The second was on the 8th June to Montebello, forty miles below Ottawa, on the Quebec shore of the river, where the excursion joined one from the Natural History Society and proceeded to the beautiful grounds of the Hon. J. L. Papineau. Three prizes for botanical collections to be made during the day were offered by this Club to the Montreal Society for competition among the members of both. These were taken by Mr. H. M. Ami, of Ottawa; Mr. Thomas Barron, of Lachute, and Miss Graham, of Montreal. Before separating, short addresses were given by Dr. Dawson, President of the Natural History Society of Montreal,

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and by Mr. R. B. Whyte, First Vice-President of this Club. The third excursion was to Meach's Lake, four miles beyond Chelsea, on the 27th of July. The fourth was upon the 29th August, to the Black Rapids, upon the Rideau River, about eight miles from the city, a locality not previously visited by the Club.

The Council, in pursuance of a vote passed at the last annual meeting, caused to be printed 500 copies of the Transactions (No. 2) of the Club for the year 1880-81, the value of which was greatly increased by a fine plate, lithographed by Mr. Grignard. The Transactions of the Club still continue to be welcomed by naturalists in other places, and are frequently requested by scientific societies in exchange for their publications.

The following exchanges and donations have been received during the year: Report of the Department of the Interior for 1880, from Mr. P. B. Symes; Annual Report for 1880 of the Librarian and Commissioner of the Nova Scotia Provincial Library; A List of Plants growing in Malden and Medford, from the Middlesex Institute, Malden, Mass.; Parts IV and V of the Transactions of the Epping Forest and County of Essex Naturalists' Field Club; Entomological Report of the Department of Agriculture, Washington, for 1880, from the Editor, Prof. Comstock; Part 3, Vol. V, of Proceedings and Transactions of the Nova Scotia Institute of Natural Sciences; Bulletin No. 1 of the American Museum of Natural History, New York; Epidermal Organs of Plants, by Chas. F. Cox, F.R.M.S., from the author; Annual Address of the President of the Scientific Society of Bridgeport, Conn.; Report of the Horticultural Society of Massachusetts for 1881.

The Naturalists' International Directory for 1881 has been purchased for the use of members wishing to correspond or exchange with naturalists elsewhere. It gives, as far as possible, the names of scientists in every country, stating the subjects studied by each person, and whether they have collections or desire exchanges.

On the 7th of April Prof. Macoun, by request of our worthy patron, His Excellency the Governor General, re-delivered his very interesting lecture upon the "Capabilities of the Prairie Lands of the North-West, as shown by their Flora and Fauna," a synopsis of which appeared in

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Transactions No. 2. His Excellency and several members of his suite were present, and the lecture was well attended. It was illustrated by excellent photographic views of scenes in the North-West and British Columbia, which were shown by Mr. Topley with the aid of a powerful magic lantern. For this lecture the Ottawa Literary and Scientific Society kindly placed its lecture room at the disposal of the Club, which also still enjoys the free use of the museum of that Society for its various meetings.

A Conversazione was conducted by members of the Club for the Ottawa Literary and Scientific Society on the evening of the 6th January, the proceedings at which were all of a scientific nature. Dr. Grant delivered an eloquent address upon the value of scientific researches and the pleasure which they afforded to those who pursued them. Readings, or addresses, upon natural history subjects were also given by Messrs. H. B. Small, J. B. Tyrrell, W. H. Harrington and Prof. Baptie. The remainder of the evening was devoted to an examination of the different exhibits and of miscroscopical animals and slides. Mounted plants were exhibited by Messrs. Fletcher, R. B. Whyte and H. B. Small. The latter showed a collection made by him in England forty years ago (showing how well they could be preserved), and also a fine volume of photographic illustrations of meteorites by Hahn. Two excellent spectroscopes were exhibited by Mr. J. Tomlinson, and microscopes by Messrs. Whiteaves, Tyrrell, Fletcher, Wickstead, Ami, Harrington, and Dr. Small. The winter course of soirees comprised five, devoted respectively to the Inaugural Address and reports, geology, microscopy and botany, entomology, conchology and general zoölogy. The following is a list of the papers read at these soirees :—No. 1. November 25th, 1881—President's "Inaugural Address," J. Fletcher. Reports on geology, botany, entomology, ornithology, and oology. No. 2. December 9th, 1881—" Some remarks on the geology of the Ottawa Valley, and on the stratigraphy in the vicinity of Ottawa City," A. R. C. Selwyn. " Notes of an exposure of the Potsdam at Buckingham Basin, Des Lievres River, Quebec," H. M. Ami. No. 3. January 13th, 1882—" Microscopic examinations of filterings of the Ottawa water supply," Rev. A. F. Kemp. No. 4. February

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10th, 1882—"House Flies," W. H. Harrington. "Notes on the Acaridæ, with description of new species," J. B. Tyrrell. No. 5. March 10th, 1882—"Ottawa Unionidæ," F. Latchford; "The Utica Slate Formation," H. M. Ami; "A Notice of the Bank Street Road Pine," Dr. Small; "Report of conchological branch." At each of the soirees, in addition to the papers of the evening, there were remarks made by members and exhibitions of specimens and microscopes.

In conclusion, the Council would recommend a division of the laborious duties now performed by the Secretary-Treasurer; also an increase of the annual subscription fee to $1, the payment of which to entitle a member to receive a copy of the Transactions, as published, and to attend the Club soirees without further charge.

Signed on behalf of the Council,

W. H. HARRINGTON,
Secretary.

OTTAWA, March 21st, 1882.

TREASURER'S BALANCE SHEET.

The Treasurer in Account with the Ottawa Field-Naturalists' Club, 1881-82.

DR.		CR.	
To Balance on Hand	$ 55 52	By Printing, Stationery, Postage, etc	$ 16 52
Annual Subscription Fees.	44 50	Prizes	5 50
Receipts from Prof. Macoun's Lecture.....	6 40	Expenses of Prof. Macoun's Lecture.....	3 50
do from Excursions.	23 95	do Excursions...	30 22
do from Soirées.....	13 30	do Soirées.....	8 50
do from Transactions.	22 84	do Transactions .	65 20
		Balance.....	37 07
	$ 166 51		$ 166 51

W. H. HARRINGTON,
Treasurer.

21st MARCH, 1882.

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CHANGES IN RULES.

In pursuance of the suggestions offered in the last paragraph of the report of the Council, Rules Nos. II and VIII, as published in Transactions No. 1, were amended to read as follows :—

II. *Management.*—The Club shall be under the management of a Council, annually elected, consisting of a President, two Vice-Presidents, a Secretary, a Treasurer, a Librarian, and a Committee of three other members, all of whom shall be eligible for re-election; three to form a quorum. Minutes of the meetings and proceedings of the Council to be duly kept.

VIII. *Annual Fee.*—The annual membership fee shall be one dollar, payable in advance, due on the third Tuesday in March, and no member in arrears shall be entitled to any of the privileges of the Club. New members to pay the fee for the current year upon election. The payment of the annual fee to entitle a member to receive a copy of the Transactions, as published, and to admission to the Club Soirées without further charge.

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FIRST SOIREE.

FRIDAY, NOVEMBER 25, 1881.—INAUGURAL ADDRESS. JAMES FLETCHER, President

Members of the Ottawa Field-Naturalists' Club; Ladies and Gentlemen:

This evening it is again my privilege, now for the third time, to deliver the opening address in our course of winter entertainments. I am happy to be able to inform you that the Club is in a very prosperous condition. Not only has the number of members on the roll been increased, but also that of those actively engaged in studying natural history and so furthering the object for which the Club was organised. As it has now become a custom of the Club to publish among other papers the inaugural address of the President in full, and as we have this evening to receive some of the reports of the different branches, my address will not be of so great a length as heretofore. In the two previous years too much space in the Transactions has been taken up by the President's address, to the exclusion of less general and therefore more valuable matter.

There are two methods one or other of which is generally followed in introductory addresses to such societies as our own. The first is to treat of some special subject; the second is to consider generally the present condition or progress of science. I shall not, however, follow either of these courses this evening. As the one selected by a Club as the chief executive officer, the President is responsible for much. He has, in the first place, to look after the working of the whole Club and see that a continuous work of scientific investigation is carried on. With the assistance of the excellent council that you elected at the same time as myself at the last annual meeting, I believe that this has been done. There is also another important duty which seems to devolve specially on myself, as President, and that is to stimulate the members to keep up their individual studies, to keep constantly before them what has been done in the past, is being done at present, and what we may hope to do in the future, and I cannot help thinking that this is the proper subject for the opening address—in fact this should be the President's annual report to the Club. I believe we are doing most valuable work towards working up the natural history of the country. We are already making a name for ourselves and are becoming a centre of reference. I have no doubt at all that as it becomes more generally known throughout the district that such an organization exists, where an inquirer can obtain readily information on such subjects as the best means of dealing

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with insect foes, or as to the value of soil, or the nature of minerals found, or the uses of our native plants—in fact of the causes and effects of all subjects treated of in the natural sciences, I believe, I say, that our opportunities for usefulness will be increased almost without limit. Immediately after their election, your Council commenced operations by sending a circular to every member, the object of which was to endeavour to get more of the members to take an active part in studying the natural history of the locality; in view of this end, and as an assistance to beginners, it was decided to appoint leaders in the different branches of science, and their duties, as expressed in that circular, were as follows:—To render any assistance in their power to the members engaged in collecting or studying in their respective branches; to bring together for mutual aid and encouragement the members interested in the same subject; to organize and direct working parties; to keep notes of work done, and report to the Council at the end of the season. These reports have been received and show very satisfactory results. In addition to the above, as an incentive to collectors and to induce others to study the natural sciences, it was decided to offer a prize in each branch for the best collection of specimens made during the year. These collections are to be properly named and arranged and submitted for examination by 31st December next, and I sincerely hope there will be a large number of collections sent in.

The second part of the Transactions of the Club, giving a record of all its proceedings for the year 1880-81 has been published. Through the generosity of Mr. Grignard it is embellished with a beautiful plate, of a new species of fossil found by Mr. W. R. Smith, at Belleville, and figured in our Transactions because illustrative of the genus Porocrinus, of which Mr. W. R. Billings found imperfect specimens of another species in this locality. It will be remembered that the concluding lecture of our last year's winter course was given by Prof. Macoun, of Belleville, on "The capabilities of the North-West Prairie Lands as shown by the Fauna and Flora." This lecture was of great interest, and a *resumé* of it is given in Transactions, Part II. At the beginning of this year, that is, immediately after the annual meeting in April, the Council received a letter from His Excellency the Governor General stating that he had been unavoidably prevented from attending this lecture, and expressing a wish that it might be repeated. Accordingly on the 7th of April Prof. Macoun came and re-delivered the lecture. He also exhibited specimens of the most important plants mentioned, and the success of the evening was much enhanced through the kindness of Mr. Topley, who showed by means of a magic lantern an admirable collection of photographic views, many of which were of the exact localities mentioned in the lecture.

During the past summer, in addition to the excursions held by the different branches, and one or two special expeditions to distant localities, too far for

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general excursions of the whole Club, the usual periodical excursions into the surrounding country for the purpose of making collections have been held. I regret exceedingly that owing to absence I was only able to attend the last of these; but from all accounts they were quite as enjoyable and profitable as those held during the previous seasons. Of the four excursions arranged by the Council during the season, the first was to the Chelsea Hills, on the 26th May; the second, the chief one of the year, was to Montebello, to meet the members of the Montreal Natural History Society. At this joint excursion it was decided by your Council to offer three prizes for the best collections made during the day, and there were two others given by the Natural History Society, of these, that for the best botanical collection, named and arranged without the assistance of a book, was taken by Mr. H. M. Ami, of our Club, with 80 species; the others were all taken by members of the Montreal society. The Hon. J. L. Papineau's kindness in throwing open his grounds and museum to the Naturalists increased materially the enjoyment of the day. Joint excursions of this nature are of the utmost value, giving Naturalists from different districts an opportunity of exchanging ideas and comparing notes. I hope we shall always be able to arrange at least one every year with our Montreal friends. The next excursion was to Meach's Lake, three miles beyond Chelsea. This is a favourite locality for the conchologist. It was here that Mr. Heron detected the rare mollusk *Physa Lordi*, which has not been found in any other locality in Canada except British Columbia, where it was first found by its discoverer, Mr. J. K. Lord. It is a very handsome and distinct species, and was well figured in Part I of our Transactions. Here, too, Mr. Latchford found a few of the handsome *Limnæa megasoma*, and there are many other interesting shells to be found there.

The last excursion of the season was on the 27th August, to the Black Rapids, on the Rideau River. This was a locality we had long wished to visit, but had been prevented by the want of a suitable boat. Dr. Wicksteed, however, again this year put his steam yacht *The Princess Louise* and her crew at the disposal of the Club for one day; the Committee then decided to make this oft spoken of trip. It proved most enjoyable. The scenery is very beautiful; it was a fine day, and some interesting specimens were collected.

Our corresponding members still continue to take a lively interest in the Club. Mr. A. J. Hill, now in British Columbia, has been collecting most energetically, and I have received from him several packets of plants, insects and seeds during the past summer, the duplicates of which I shall distribute among the members of the Club as soon as I have named them all. Many of them have never been recorded on the Canadian lists. One of the plants, called *Lewisia rediviva*, is of peculiar interest, and is worthy of a short notice here. It belongs to the order *Portulacaceæ*. Mr. Hill writes me from Ashcroft in May last as follows:—"I send you specimens of a beautiful little pink flower, which is now in blossom here in one

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spot in great profusion. It appears first of all, early in the spring, as a small tuft of green fleshy grass-like leaves. These after a while, and immediately before the flower buds appear, wither down, so that the plant while in blossom has no foliage at all; but bud after bud comes out of the upper extremity of the rootstock, till in some instances it shows a crown of six or eight of the loveliest pink flowers, much resembling in general appearance and consistency small fully expanded cactus flowers." These flowers in some of the specimens Mr. Hill sent are an inch in diameter, are borne on short fleshy scapes, which are jointed above the middle, where they bear 3 to 7 awl shaped membranaceous bracts, and have from 8 to 12 petals, the outer ones of which are ovate and the inner oblong linear; they are semi-translucent and rose-coloured, veined with red; the stamens and anthers are a deep rose colour and vary in number from 16 to 32, they have a very beautiful effect as they lie back on the delicate corolla; from their centre springs the pistil, which is white and divided up at the summit into 6 or 8 thread-like stigmas; the calyx adds much to the appearance of the plant, especially before the flower buds expand; it is composed of 6 or 8 broadly ovate petaloid sepals of a delicate brown colour. Mr. Hill writes futher that "the flowers like those of the Portulaca expand only in the bright sunshine," and he continues: "It appears like sacrilege to tread on the beautiful thing; but in some places they are so thick that it is impossible to avoid them; they are however confined to a very circumscribed area on the meridian of Ashcroft." The roots are thick and short, and in Oregon, near the mountains, where it is plentiful, it is called *spatulum* or *spætlum* by the natives who gather the roots and use them as an article of food. The bark being stripped off, the inner portion is found to be white and farinaceous; this is boiled in water, when it forms a substance similar to boiled arrowroot. The specific name *rediviva* is very appropriate, for the roots are so exceedingly tenacious of life that some specimens Mr. Hill collected in May last after having been carried about in a packet of other dried specimens all the summer and supposed to be quite dry, were found on opening the parcel two weeks ago to be sending out healthy crests of leaves. Some of these I planted and they are growing vigorously. Among the correspondents from whom we have received publications will be noticed the Epping Forest and County of Essex Field Club. When in England last summer, as your President, I experienced much courtesy from the council and members of this Club; I was made an honorary member for the period of my visit, and received invitations to all their meetings; I was fortunate enough to be able to attend one of their excursions, and this day was one of the most enjoyable of my whole holiday.

The Epping Forest and County of Essex Field Club has a membership of over 300, and is a larger and more influential institution than any other of the same nature in England. It was organized about the same time, and with exactly the same object, as our own club. They have already published five

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parts of Transactions in the two years and a half. It has occurred to me that, being constituted so like ourselves, an account of one of their field days will not only be entertaining to most of you, but may also be suggestive of some valuable ideas of which we may take advantage, so as to render our own excursions as attractive as it is possible to make them. The excursion referred to was held on 25th June, at Chigwell, in Essex. The beautiful scenery around this place has been graphically described by Dickens in his "Barnaby Rudge." The members of the Club met at the railway station and then walked to Chigwell, a distance of about two miles, through lovely English lanes. I say English lanes, and I think anyone who has ever seen one will appreciate my drawing special attention to them They are a characteristic feature, and I believe not to be found of the same description in any other country. Few things are more beautiful; their steep banks of refreshing green, surmounted by well trimmed hedges, and clothed from top to bottom with feathery grasses and lovely flowers, breathing forth delicious odours, have an effect little less than enchanting on visitors from other climes. Their beauty is ever varying; plant after plant throughout the whole summer, succeeding in its turn, claims the reward of its effort by forcing up its head into the sunlight to bear its corolla or crown of glory; the gay butterfly with bejewelled wings adds its charm to the scene; and the hum of the bee as it hurries by is no unimportant factor of the whole. Truly this sum of beauty should be sufficient to demand from all—the most unobservant—some small share of attention. But is it so, my friends? I regret, for the sake of the happiness of the many, to have to say it is not. While at Chigwell some of the party took the opportunity to visit the Kingshead Inn mentioned by Dickens, and the old parish church, which contains a rich collection of ancient brasses and monuments. Two of the most interesting for their age are a monument to T. Cateshill, who died in 1595, and a brass to Archbishop Harsnett, formerly master of the Grammar School there, and founder of two schools—one for young children and the other for teaching Latin and Greek, and the founder expressly stipulated that the master of the latter should be no "puffer of tobacco." Perhaps there is no object of greater interest in the village than a curious avenue of yew trees, which forms a covered way from the church door to the road, a distance of about twenty yards. The trees stand in two rows, and, as far as I can remember, are about twelve feet apart; the branches, springing out horizontally about ten feet from the ground, meet overhead, and form so dense a mass that it is quite impossible to see daylight through them. The trees are not large specimens, few of the trunks having a diameter of more than twelve inches; they are, however, supposed to be very old, and one of the members, Mr. Unwin, who, before we left the churchyard, read a short and interesting paper on the history of the parish, also exhibited an illustration of the church more than 100 years old, which showed the avenue exactly the same as

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it now appears. In England the yew tree is the typical form of *Taxus baccata*, *L.*, and grows to the size of a large tree, sometimes fifty feet high, with a massive trunk. One specimen at Hounslow has a girth of 27 feet. This tree little resembles our Canadian variety of the same plant, *Taxus baccata*, *L.*, var. *Canadensis*, Gray, which is a low straggling shrub growing in swampy woods and seldom more than three or four feet high, and does not form a trunk at all. The paper ended, we continued our walk as far as Oakhurst, the residence of the Rev. W. Linton Wilson, the Vice-President, where a large schoolroom was put at our disposal. After some time spent in the examination and comparison of specimens collected during the day, our host summoned us into an adjoining room, where a sumptuous repast had been prepared, to which ample justice having been done we all took our seats for the great attraction of the day, a paper on Infusoria, by Mr. Saville Kent, one of the highest authorities on these minute animalcules. The paper was virtually an outline sketch of Mr. Kent's magnificent work now in course of publication. Judging by the parts which are already issued, it is by far the finest work ever published on the subject, and will be a necessary companion for anyone taking up this interesting study. In illustration of the paper Mr. Kent sent round the room a complete set of the illustrations with which his book is to be embellished; there were also several living specimens collected during the day which were examined through microscopes of which there were several very fine ones brought by different members. Subsequent to the paper there was much interesting discussion, and the difficult points were ably explained by the lecturer. There was also read a communication from Mr. English upon a new method of preserving plants in their natural shapes, beautiful specimens being at the same time exhibited, which might easily have been mistaken for living plants, so well had their shapes and colours been preserved.

I have noticed this excursion at some length because I think that it will be of use to us to see how others doing the same work as ourselves carry on their proceedings. It will be found by the reports to be read that much work has been done by ourselves in many lines of natural history, but yet I must express a hope that next season will produce some active students in one or two of the branches which so far have attracted little attention, as well as some specialists in those which have already been worked. Something new is sure to turn up even in a study of the most common objects when submitted to an exhaustive investigation. In the small family *Nuphar* I believe I have succeeded in discovering during the past season that what has been considered a form of *N. luteum* by American botanists, and which was added to our Ottawa list last year under the name of "*N. luteum*, Smith var.," is only a hybrid between *N. advena* and *N kalmiana*. I am led to this belief from an examination of the fruit; but so far my conclusions have not been confirmed by any other botanist. This, however, is

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sufficient to show that much interesting information may be derived from well trodden paths. I am surprised that so few have turned their attention to ornithology, the study of those gay visitors which add such an indescribable charm to our sylvan rambles. I hope to see a microscopical branch organized at an early date. To anyone who can afford the luxury of a microscope, unlimited amusement and instruction is in store. No one can once enter upon this study without being compelled to become an enthusiast. It opens up such new worlds and fields of thought that the mind is almost overwhelmed with wonder and reverence for the Omnipotent Being who created such marvels of beauty and adaptation to required uses. The fact that nothing is useless is forced upon our minds with such force as almost to cast everything else into the shade. I am particularly anxious next year to see great life in the Club, so as to take as much advantage as possible from the visit of the American Association for the Advancement of Science to Montreal, when I hope not a few of our members will join that noble Association.

Scientific life in Canada may be said to have had its birth in 1857, when the last meeting of that association held in Canada was convened, and now, when it is held here again, I have the most sanguine hopes that it may be the cause of a renaissance in scientific studies in Canada. There are few cities in the Dominion which possess so many advantages, and opportunities for learning, as Ottawa does, for all who are desirous of obtaining a knowledge of scientific matters. First of all, of inestimable value is the magnificent museum of the Geological and Natural History Survey, which removes already every excuse for ignorance upon geological and mineralogical matters, and as soon as the collections in the other departments of natural history are completed we shall have here a source of reference upon every subject of interest to the naturalist. The addition of such men as Dr. Selwyn, the director, Mr. Whiteaves, and Dr. George Dawson, among others, cannot fail soon to make itself felt in society here. Their eminence and reputation as naturalists are not confined to this country but are of world-wide acceptance in scientific circles. The museum is now open to the public, and has been arranged so that its economical collection can at once be referred to by anyone desirous of identifying or learning the uses and value of any mineral deposit. There is of course also a scientific collection for the use of scientific students. The next institution worthy of mention in this connection is doubtless the Library of Parliament, where the best works on most subjects are always to be had for reference. The Literary and Scientific Society too, with its learned President, the Rev. Dr. Kemp, is an institution well calculated to help on the cause of science. The Museum, although small, is possessed of several valuable and typical collections for reference ; the Library is good and there is every year a course of science lectures which every member of this Club would do well to attend. In many of the Departmental reports published by the Government will

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be found accounts of explorations and experiments which are of great interest to scientific men.

In connection with St. Joseph's College there is a Geological Society and well arranged museum. The Institut Canadien has its science classes, and of course so do also the Normal School and Collegiate Institute. In short, there is no excuse at all for anyone in Ottawa to plead ignorance on scientific subjects. Let us then strive to make the most of our opportunities, and do our utmost to render our Club of the greatest possible usefulness. Let us proclaim by our works that we wish to help on the general cause of science. Let each of us strive to cultivate his faculty of observation, so that nothing of interest escapes our notice. The notebook should be the naturalists' constant companion, the time of the appearance and departure of every bird and insect should be noted, the occurrence of every rare animal, fish, or shell, the discovery of every mineral or interesting fossil remain—all of these should be recorded.

We must not, however, content ourselves with only making observation and collecting facts. This is not science. Science is organized knowledge. Our observations, therefore, must be arranged, and recorded systematically in the clearest possible way, for our own use and for the use of others. The literature of science, especially periodical literature, has become so powerful and voluminous that without it progress is impossible to the student; this renders it necessary that all facts should be recorded in as concise and exact a manner as possible. No one can contemplate the progress of physical science during the past century without feeling that a new era has begun in the history of man. The powers of the human mind are extending their grasp and rising to a state of higher activity. The nature and order of material things are exhaustively investigated from the infinitely great to the infinitely small. The causes and effects of things are sought out most persistently. Physical science scans alike the distant orb from which we receive light and heat and also the imponderable and invisible particle, and demands from insentient matter the laws of its being. Scientific inquirers were doubtless at all times thus engaged; but formerly there was too much scope given to the imagination and too little observation and experiment. Systems were built up on arguments derived from the probable rather than the actual and proved. The strictness of logical conclusions was held to be of more account than honest labour in ascertaining the correctness of the data on which the conclusions were built. This, however, is not the case to-day. No assertion in science remains long unchallenged, and the statements of philosophers are submitted to every ordeal, and their conclusions tested by every criticism which honesty, acumen or fierce partizanship can apply. One of the great characteristics of the scientific activity of the day is its practical tendency. The public expects from its thinkers and experimentalists not clever paradoxes and ingenious puzzles, but plain methods of grappling with stern necessities—discoveries by means of

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which the powers of nature may be subjugated to the powers of man in his ceaseless struggle with her material elements. Scientific researches into the constitution of things which by the ignorant are too often assumed to be useless in their application to the practical affairs of life, are by the intelligent now appreciated as honest efforts to add to the sum of verified facts, which are of the highest value, not only as truth, but also as disconnected links which may at any moment be connected by others and produce practical good. Medical science furnishes numberless examples, particularly in the history of Zymotic and other microscopic diseases.

The scientific genius of the age, too, has responded to this demand for tangible results. Students have ceased to speculate upon unsubstantial theories, and no longer spend their lives in search of the "Philosopher's stone" or the "Elixir of Life." Science is no longer a lifeless abstraction floating above the heads of the multitude. It has descended to earth and mingles with men. The history of modern times is full of instances of this. It is by a knowledge of science that we are able to seek out and detect the mineral treasures embowelled in our mountains; by the same power we are enabled to dissolve from their stony beds the organic remains of former ages and re-use them to fertilize again our fields. It teaches us how to combine elements which separate are inert and harmless, but which united can in a moment of time demolish structures which have taken years to build. In the art of photography it has given to man the sunbeam as a pencil infallible in the accuracy of its delineation, and in the electric telegraph it has given him the lightning of the clouds as a messenger.

The powers and benefits bestowed upon man by science are so numerous that no one now dares to speak slightingly of her. The hidden forces of nature, the laws by which her phenomena are governed in all their variety and succession, everything is undergoing a rigorous scientific investigation from which result discoveries that would be deemed simply miraculous did not their number and frequency almost exhaust our faculty of wonder.

REPORT OF THE GEOLOGICAL BRANCH

For the Season of 1881.

To the Council of the Ottawa Field-Naturalists' Club:

The leaders of the Geological Branch of the Club, in presenting this, their first annual report on the proceedings of that division of the Club for the field season of 1881, regret that, owing chiefly to the small number of members interested in geology, it was found impossible to carry out the intention of the Council to organize working parties, or to hold periodical short excursions of the branch; and consequently the work accomplished has been by members individually, and almost wholly in the palæontological section.

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In mineralogy there is no work to report, and it has been deemed advisable to withhold some notes that were made of stratigraphical observations until a more connected and comprehensive report could be prepared, to include future observations. It is very desirable that this branch should make a united effort to accomplish a thorough survey of the stratigraphy of the surrounding townships, and this year's leaders recommend to the attention of their successors for the ensuing field season the desirability of systematically beginning such a work.

It is thought that a few new species of fossils have been found, but it has been necessary to prepare this report so early in the year, before the field work can be said to have actually ended, that the collectors have not been able to put their specimens in order, determine doubtful varieties, and prepare lists or descriptions of them.

It has also been found, in compiling the notes submitted, that the substance of many of them was already contained in the "Geology of Canada, 1863," so that it is unnecessary to issue them in this report. In fact all the observations of the branch bear testimony to the wonderful accuracy and extended scope of that valuable work.

The most systematic and important effort of the year consisted of an exploration of the celebrated Bird's Eye and Black River outlier at Paquette's Rapids, at the foot of Allumette Island, where Messrs. Billings, Ami and Soutter, of this Club, spent a week collecting fossils, in company with Mr. Hurlburt, the accomplished palæontologist of Utica, N. Y., and Mr. Weston, of the Exploring Staff of the Geological Survey of Canada. The greater number of these specimens were found to be of species identical with those of the Little Chaudière beds, referred to hereafter.

In the absence, then, of comprehensive notes from which a full report of the year's work could be compiled, it may be interesting to the members in general, as well as a help to the younger ones desiring to begin the study of palæontology, to give a list of the different localities in this neighbourhood in which the several formations may be found, at the same time indicating the best fossiliferous beds.

Taking the rocks in ascending order, the Potsdam sandstone, the lowest member of the Lower Silurian age, and the one immediately succeeding the rocks of the Archæan era, is found at the Nepean quarries on the Richmond Road above Britannia; at Lake Windeago, East Templeton; and at Buckingham Basin, on the property of Mr. Bangs. An exposure is also reported as occurring at Hog's Back.

No fossils have been reported from the Potsdam in Ottawa, nor from the formation next in order of age, the Calciferous, which occurs at Hog's Back and the Black Rapids on the Rideau River, nine miles from the City, where the Club held one of its excursions last summer. Casts of Calciferous fossils have been reported as seen in a quarry on Mr. Robert Skead's Farm, South Shore of the Ottawa, opposite Duck Island.

Mr. J. H. Bell reports a very interesting exposure in Marlborough, about 30 miles south of the City, probably referable to the Calciferous sand-rock; rich in fossils, and with crystals of quartz, making brilliant patches on the surface as they glisten in the sunlight. It is proposed to give to the Club a detailed description of this exposure in a separate paper.

The formation which comes next, the Chazy, has in this locality so far proved poor in fossils. The beds at Aylmer and south-east of the mouth of Green's Creek are the best in the immediate neighbourhood, no very interesting fossiliferous beds being known nearer than L'Orignal or Grenville.

The Bird's Eye and Black River formation, constituting the base of the Trenton group, is, on the contrary, specially rich. The Little Chaudière, on the Hull side, is, when the water is low, the best place in this vicinity. Fossils are also found in a similar bed on the Ontario shore opposite, on Lots 3 and 4 in

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Concession 3, Rideau Front of Gloucester; Lot N, Concession A, Nepean; at the summit of the Chazy outcrop already referred to south-east of Green's Creek, and at the quarries near Hog's Back, on the Gloucester side of the Rideau River.

The formation next in order is the Trenton, and as most of the limestone in the immediate vicinity of the City belongs to it there are many fossiliferous localities that would repay careful attention, but only a few of the richest known are mentioned. That at Barrack Hill, described in the Geology of Canada, 1863, as most productive of new species, and from which was obtained the greater part of the crinoids and cystids described in Decades 3 and 4, does not seem to be accessible now, having probably been covered by debris from the excavations for the Lover's Walk.

Good fossiliferous localities, and easy of access, occur east of the steamboat landing on Sussex Street; at McKay's Bay; the quarry at Brigham's Lake, Hull (Crinoids); Wright's quarry, Hull; at the railway cutting immediately west of the crossing of the Aylmer road (Monticuliporæ); at the old lime kilns, Mount Sherwood; and above the Chaudière Falls on the Hull side of the river, at low water.

Beds of the Utica formation, constituting the base of the Hudson River group, and immediately overlying the Trenton, occur on the banks of the Rideau at the rifle range, at Cummings' Bridge, at a small creek between Cummings' and Hurdman's Bridges, and in the brook above Billings' Bridge. Mr. Ami is preparing for the Club a paper upon the fossils found by him in these beds.

No formations more recent are known to exist near Ottawa until the post-tertiary clays are reached, of which there are good fossiliferous localities below Rockliffe on the south bank of the Ottawa, when the water is low; at the mouth of Green's Creek, and in the gravel beds at Gloucester station on the St. Lawrence and Ottawa Railway.

In conclusion it is hoped that a large number of members of the Club may be induced to pursue this most attractive branch of field work during the coming season, particularly now that the headquarters of the Geological survey have been brought to Ottawa, that the magnificent collection in its museum will shortly be open for study and comparison, and that some of the officers of the survey who are members of the Club may be induced to lead this branch with the success that their high scientific attainments would ensure.

WM. P. ANDERSON,
W. R. BILLINGS,
H. M. AMI,
Leaders of the Geological Branch.

REPORT OF THE BOTANICAL BRANCH

For the Season of 1881.

To the Council of the Ottawa Field-Naturalists' Club:

In making a report of the work done in the Botanical Section during the past year, your committee must first congratulate the Club on the progress made in this branch and on the success that has attended the system inaugurated this season. We also take this opportunity to thank the members for their evident desire to render our duties easy, and for the interest they have shown in the work of the new system.

Owing to the spring circular having been issued after the botanical season had opened; some who would have liked to commence work with the Club, for

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want of preparation, posponed their beginning until another year; and, to judge from the many who have sought information regarding the collection and preparation of specimens, the fruits of this season's work will be evident next year in the increased number of working botanists. This year six new collections have come under our notice and the same number of new collections may be said to be in possession of the Club.

In accordance with the notice contained in the circular, a series of sub-excursions was organized. Your committee started each Tuesday morning, from the west end of the City to the woods in that vicinity, and each Thursday morning, from the east end to McKay's woods and Beechwood Cemetery. In the latter localities much valuable work was done to improve our knowledge of their flora, a complete list having been made of all the species observed and the date of their first appearance in flower, together with other notes of interest. As opportunities offered themselves, Saturday afternoon excursions were made throughout the season to points at a greater distance. Of the most noteworthy was one to the neighbourhood of Billings Bridge, where the *Trillium Cernuum* formerly grew in great abundance; but owing to the wood where it was most abundant having been destroyed only two imperfect specimens were obtained. Another similar excursion took place to the Mer Bleue, where *Woodwardia Virginica*, *Scheuchzeria palustris* and other bog plants were collected, including a remarkable *Viola* with very long petioles; in some instances nearly 6 inches in length. After careful examination it has been referred to *V. blanda*. Templeton, Hogsback, Mechanicsville, Lake Flora and other places were also visited. In addition much individual work has been done by members, and we are pleased to note that the important branch of aquatic plants has received full attention, as will be seen on reference to the list appended.

The plants added this year to the Flora Ottawaensis are 31 in number, some of which are very rare. More we expect will be added during the winter when members arrange their summer work and competitive collections and lists are sent to the council. This is very satisfactory considering the thorough manner in which the locality has been worked in former years.

The following are a few of the more important plants on the list:

Polygala paucifolia. The only specimen found recently in this locality was gathered by Mr. H. Ami, near the St. Louis Dam, but the late Mr. B. Billings collected it in 1866. It was also found at Montebello and was noticed among some plants sent from the Mattawa District.

Rosa Carolina, Swamp Rose, was found near Meach's Lake.

Wolffia Brasiliensis, in the Rideau Canal.

In the difficult and little known genus *Potamogeton*, Mr. Fletcher has done much valuable work, which we hope the Club will benefit by on some future occasion. Referring to this work he writes: "I have found the rare "emersed form of *Potamogeton Vaseyi* in the Rideau Canal, with well developed "floating leaves. I was not successful in securing the fruit, all the floating "leaves having been destroyed by insects before it matured, which made it "impossible to discover the plants." In reference to another species he writes: "*Potomogeton Robbinsii* I found in Meach's Lake; but without flowers or fruit. "The Rev. T. Morong, the leading American specialist in this family, writes me "as follows with reference to this plant: 'It had been hunted for in fruit for 20 "years or more, in vain until two years ago, when it was found near Ashland, "in Mass. It had always been considered a submerged form previous to this, "but that year the water was very low and some of the stems reached the surface "and bore fruit; as a rule all the submerged species or forms are reproduced "by gemmæ."

Isoetes lacustris.—This curious plant, which has been classed Club Mosses, was found by Mr. Fletcher in Malloch's Bay, near the railway, at the lowest point attainable by the water falling.

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Several new plants were found by members, but at a distance too great to be added to the list; as they will probably be found in this locality, their names are here mentioned as a guide: At Paquette's Rapids, *Sagittaria pusilla*, Nutt., *Helenium autumnale, L.*, *Eriocaulon septangulare*, With.; at Montebello, *Allium Schœnoprasum*, L., *Convallaria majalis*, L., and *Arabis hesperidoides*, Gray

Before closing the report we would urge upon each Botanist the necessity of a more systematic method of work. If each would take a particular locality and prepare a list of all plants growing there, the Club would soon be possessed of the most valuable information. We would further urge all to make notes of the work done and prepare a report for the leaders at the close of the season. A few have done so this year but the majority have neglected this duty. We would advise those about entering the study to commence work at once, by learning the system upon which the science is based and examining all collections they have access too, thus becoming familiar with the work they intend to pursue; and we would ask all to apply freely to the leaders whenever aid or information is required. It must be borne in mind that they are appointed for use only, and are to be looked upon as Club property.

BEAUMONT SMALL, M.D,
R. B. WHYTE,
Leaders of the Botanical Branch.

APPENDIX.

Flora Ottawaensis; Additions to Previous Lists.

Nymphæaceæ.
Nymphæa tuberosa, Paine.
Caryophyllaceæ.
Lychnis diurna, Sibth.
Spergula arvensis, L.
Polygalaceæ.
Polygala paucifolia, Willd.
Leguminosæ.
Astragalus Cooperi, Gray.
Rosaceæ.
Rosa Carolina, L.
Umbelliferæ.
Heracleum lanatum, Michx.
Compositæ.
Nardosmia palmata, Hook.
Aster miser, L., *v.* hirsuticaulis, Gray.
Solidago serotina, Ait.
Centaurea Cyanus, L.
Plantaginaceæ
Plantago media, L.
Convolvulaceæ.
Calystegia sepium, R. Br. *v.* Americanus, Sims.
Solanaceæ.
Physalis pubescens, L.
Cupuliferæ.
Quercus coccinea, Waug.
Betulaceæ.
Betula nigra, L.
Salicaceæ.
Populus monilifera, Ait.
Lemnaceæ.
Wolffia Brasiliensis, Weddell.
Naiadaceæ.
Potamogeton Vaseyi, Robbins.
(*Emersed form.*)
Ionchites, Tuck.
gramineus, L. *v.* graminifolius, Fries.
lucens, L.
perfoliatus, L. *v.* lanceolatus, Gray.
pusillus, L. *v.* major, Fries.
v. tenuissimus, Mertens and Koch.
pectinatus, L.
Robbinsii, Oakes.
Cyperaceæ.
Cyperus phymatodes, Muhl.
Eriophorum vaginatum, L.
Filices.
Cystopteris fragilis, Bohn.
v. dentata, Hook.
Lycopodiaceæ.
Isoetes lacustris, L.

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REPORT OF THE ENTOMOLOGICAL BRANCH

For the Season of 1881.

To the Council of the Ottawa Field-Naturalists' Club:

In compliance with the instructions received from you I beg to submit a brief report upon the work done in Entomology. This important branch of science offers such a fine field for the investigations of our members that it is pleasing to note even the slight increase of interest therein that was manifested during the past season, and which was noticeable at our excursions. Many insects were brought to me during the summer and others taken to our president; some of these were brought for identification and information regarding their habits, while the remainder were contributions to our respective collections. The season for insects began at least two weeks earlier than in 1879 or 1880; such common forms as flies and spiders appearing before 15th March, on which date a number of small coleoptera, chiefly carabidæ, were observed. On the same day appeared *Apis mellifica*, Linn., the honey-bee, and *Polestes annulatus*, or mud-wasp. The latter is very abundant during the summer, and may be seen in large numbers upon the watered streets, gathering the moist lime-stone dust with which it builds its cells. Hundreds of these cells may be found under the stone window-sills and cornices of the Parliament Buildings. This wasp remains, in diminishing numbers, until the end of October, and stray ones may occur even later on sunny days. *Pieris rapæ*, Linn., the cabbage butterfly, was noticed on the 1st of April, but during the first week of that month there was a continuous cold penetrating north wind, with low temperature, so that insect appearances were reduced again to the minimum. A recurrence of bright warm weather brought them forth in rapidly increasing number and variety, and during the remainder of the spring they were very plentiful. On the 9th April hybernated specimens of *Vanessa antiopa*, Linn., the butterfly by some known as the Camberwell Beauty, were in flight, and on the following day tiger beetles, *C. purpurea*, Oliv., were numerous in dry fields. About the 20th mosquitoes began to make their presence felt both by members and non-members, and in some of the neighbouring woods they were more than usually obnoxious. On the 24th, in a young pine-grove, on the other side of the Ottawa, I obtained a number of Buprestidæ, though not expecting to find them abroad so early. Of *C. Virginiensis*, Drury, I took 1 male and 2 females, and of *C. liberta*, Germ., 14 males and 13 females. A few pine weevils were also seen, and many of the pine saw-flies.

The currant saw-fly, *Nematus ventricosus*, King, also about this date was depositing its eggs, and as these hatch in about a week the young worms were at their destructive work by May-day, new broods appearing all through the summer and requiring constant watching.

On May 6th (Saturday afternoon) a botanical and entomological party visited the woods in the vicinity of Billings' Bridge, and about 25 to 30 species of coleoptera were collected. Among these were *Serica sericea*, Ill., of which numbers were found feeding upon wild gooseberry bushes, and *Chrysomela elegans*, Oliv., of which the food-plant could not be discovered although the beetles were abundant. *Platycerus quercus*, Weber, was found to be destroying the buds of maples and other trees by eating them completely out, so as to leave but a shell, thus killing the leaf-clusters. The beetles were found in the buds, sometimes a pair in a bud. Many of the curious larvæ of *Photinus angulatus*, Say, one of our fire-flies, were observed crawling upon the trunks of trees in swamps, or suspended by the tip of the tail to the bark in the same manner as the larvæ of the Coccinellidæ, or lady-birds, when changing to the pupa state. The sultry weather of the following week brought forth swarms of insects of all varieties, and a very fair collection might have been made in the city.

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The insect fauna of the Hull side of the river is in my opinion richer than that of this side; many insects occuring abundantly there that I have not seen on this side. This was quite noticeable during a short trip that I made (21st to 24th May), with two other members of the Club, to the Wakefield Cave, about 20 miles north of Ottawa. We obtained, for instance, three species of tiger beetles, *C. longalibris*, Say., *C. limbalis*, Kl., and *C. 12-guttata*, Dej., which I have not taken in this county. *Conotrachelus nenuphar*, Hbst., the plum-weevil, was very abundant on wild cherry trees; and I may note that there was scarcely a tree unaffected by "black-knot." Several specimens of *Pachyta monticola*, Rand, were captured flying about elder flowers.

On the 27th May a Club Excursion was held to Chelsea. The day was very bright and hot, and favourable for entomologizing, but the wood being almost entirely beech the variety of species found was not great. *Ithycerus novaboracensis*, Forst., the beech-weevil and largest Canadian curculio, was exceedingly numerous; specimens were seen on nearly every beech tree, and sometimes several on the same tree. *Dicerca divaricata*, Say., the beech-borer, was also common, and specimens were observed depositing their eggs in old trees. Among other beetles found on that day may be mentioned *Calchophora fortis*, Lec., *Dicerca tenebrosa*, Kirby, *Alaus occulatus*, Linn., and *A myops*, Fabr., and *Corymbites cruciatus*, Linn. On the 31st May, *Chrysobothris Harrisii*, Hentz., was taken on pine and the weevils infesting that tree were abundant. For the 4th June I have a record of over 60 species of Coleoptera, but butterflies appear to have been less abundant than in some former seasons, some species which occur here not having been observed at all. Among the beetles may be mentioned *Saperda vestita*, Say., basswood-borer, *C. nenuphar*, Herbst., plum-weevil, *Anthronomus quadrigibbus*, Say., apple-weevil, *Psenocerus supernotatus*, Say, currant-borer, and *Saperda candida*, Fabr., the apple-tree-borer. The latter beetle I have as yet found only beyond Hull, where it occurs upon the shad-bush or service-berry and seems to be increasing in numbers. Three years ago a single specimen was captured, whereas last summer several could be taken in an hour's collecting. On the occasion of the Club's excursion to Montebello, on 8th June, a great variety of insects were observed, including species not occurring here within my knowledge. I have made a synopsis of the beetles collected by members of the Club during that day and give the number of species in each of the principal families collected:—Cicindelidæ 1, Carabidæ 35, Scarabæidæ 8, Chrysomelidæ 15, Elateridæ 13, Curculionidæ 13, Coccinellidæ 5, Staphylinidæ 6, Cerambycidæ 3, Lampyridæ 9, Mycetophagidæ 3, other families 18, in all 129 species Coleoptera. The Carabidæ were nearly all taken under drift-wood and leaves on the damp shady shore, and a search for this family in such localities will always be well rewarded. The sandy shores of Kettle Island would be a good locality to investigate. While insects were unusually abundant during May and June, the two following months were not so prolific as was expected, owing probably to food plants having partially failed on account of the dry season. During the summer Mr. W. L. Scott informed me that a number of grape vines at Fairview (residence of Hon. R. W. Scott) had been attacked by a small active bluish beetle. This beetle is named *Graptodera chalybea*, Ill., and is commonly known as the "grape-vine flea-beetle." The eggs are laid in the spring upon the young leaves, on which the small dark-coloured larvæ feed, perforating them with holes, and, if numerous, stripping the vines. The greatest injury, however, is wrought by beetles which live during the winter under the bark, in crevices, etc., and perforate and destroy the buds just as they begin to swell in spring. The tortoise-like beetle *Chelymorpha argus*, Licht., was abundant in July and August and individuals varied much in their markings. Specimens were brought to me by different persons, who considered them to be unusually rare and curious beetles. During the season larvæ of *Sphinx quinque maculata*, Harworth, were exceedingly common upon tomato plants, and another sphinx, *Deilephila lineata*, Fabr., occurred abundantly in September, as evidenced by the

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number seen about the flower beds on Major's Hill. A full grown larva of *Philampelus achemon*, Drury, was taken by Mr. J. C. Stewart upon Virginia Creeper (Ampelopsis quinque-folia) and others were found by Messrs. James Young and John Christie feeding upon grape-vines. Empty cocoons of the beautiful moth *Callosamia promethea*, Drury, were found near Hull, but repeated search failed to discover the larvæ or new cocoons. Two captures of another splendid moth must be recorded. This moth, *Erebus odora*, Say, is a southern form and its occurrence here is therefore particularly interesting. One was taken by Mr. Geo. Patrick, in a room in the Western Block, the other by Mr. Pim in a doorway of the Government Workshops. Many other very interesting insects might be noted, of which one is *Aletia argillacea*, Hubn., the cotton-moth, which appeared frequently during the early part of October, as it also did in 1880. Some beetles were obtained from fungi as late as 10th November. To my own collection of of coleoptera of the vicinity, I added during the season about one hundred new species, the majority of which are as yet unnamed. In concluding this report, I would respectfully ask you to endeavour by all means in your power to impress upon the members the importance of the study of Entomology, a branch of Natural History offering to students more opportunities for original research and valuable work than many of those which are now so popular.

W. H. HARRINGTON,

Leader of the Entomological Branch.

REPORT OF THE ORNITHOLOGICAL AND OOLOGICAL BRANCH

For the Season of 1881.

To the Council of the Ottawa Field-Naturalists' Club:

When at the beginning of the present year leaders were appointed for the various branches those of the members of the Club who were already interested in the study of Ornithology and Oology lost no time in putting themselves in communication with the leaders named for those branches, and in endeavouring to persuade as many others as possible to take up these studies. The following Report, however, is confined principally to work done in Oology, as that was the special study of the greater number of the members of the branch. Sub-excursions in this branch were organized once or twice a week during the latter half of May and the greater part of June, at which the most interesting localities in the vicinity of the City were visited. One of these was Wakefield Cave, an object of great interest in its self and situated in a locality most favourable for the study of all the branches of Natural History. It has been suggested that if too far for a general excursion of the Club, sub-excursions, similar to the one mentioned, might be organized next spring by the leaders in the different branches to visit this interesting spot; when it is confidently hoped good results would follow. On this excursion which was held about the 21st of May, we succeeded in discovering on one of the many small lakes near the cave a nest of the Common Gull (Larus argentatus, Brunn.) but we were unfortunately too late, as not only were the eggs hatched, but the young had already left the nest; from this fact it is probable that with this species the period of incubation is

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very early in the season. The nest, which was very shallow, was built almost altogether of dried moss, and was placed on the top of a small rock, which extended about a foot and a half out of the water, towards one end of the lake.

About the same date Messrs. L. Brophy and R. Bauset visited Lake Wilson in the vicinity of the Pêche, P. Q.; and succeeded in making two valuable finds. The first of these was the nest of a Black Duck (Anas obscura, Imelin) containing six large greyish green eggs blotched with dull yellow. The nest, which was of moss, was built on the ground in the centre of a clump of trees on a small wooded Island in the Lake. The second was the nest of a Great Northern Diver or Loon (Columbus torquatus, Brunn) containing two eggs, olive green rather thickly marked with large and distinct dark spots. They also saw, in the crown of a very tall snag on one of the Mountains near the Lake, the eyry of a White Headed Eagle (Halialtus Leucocephalus, Savigny,) but not having climbing irons with them they were unable to reach it.

Among a number of nests of the Crow Black Bird (Quiscalus purpureus, Lechtenstein) which were examined near Chelsea, two deserve special mention. The first of these contained two eggs similar in size and shape to the ordinary ones of that species, but the colour of the ground work was lighter and more delicate, and, while one was thickly covered with light brown spots, the other was besprinkled with dull purple ones. In another nest an egg was found which nature had apparently meant especially for the leader of the Oological Branch, for on one side of it was drawn as distinctly and as neatly as if done with pen and ink, a large "W" with inside of it a smaller "L" and "S." The egg was stamped by nature with his monogram, all ready to be placed in his collection.

On one of our excursions the nest of a Peewee Flycatcher (Sayomis fuscus, Baird) was taken containing five eggs, four of which were marked with small brown spots. Although it is very unusual for the eggs of the Peewee to be spotted in this manner, yet the fact of their being so is noticed by many writers. A set of eggs of the Sand Martin (Cotyle riparia, Boie) was obtained which were also spotted, a peculiarity that as far as could be learned has never been recorded.

Among the many birds which, returning year after year to gladden us with their joyous carols, grow to be familiar friends about our houses, there are some which apparently depend entirely on the habitations of man for a place in which to build their nests. Of these are the Chimney Swallows, (Chætura pelasgia, Stephens); Eave Swallows, (Petrochelidon lunifrons, Cabanis); White Bellied Swallow, (Tachycineta bicolor, Coues); Purple Martin, (Progne purpurea, Boie), and many others. That these birds however, may and sometimes do find a substitute for eaves, sheds and bird houses, is proved by the fact that some half dozen pairs of white bellied swallows were observed building in deserted woodpeckers' nests in a tall tree situated on the banks of the Rideau River not far from Billings Bridge. The nest of the Wood Peewee (Contopus virens, Cabanis), besides being rare is extremely neat and curious, and therefore deserves a special description. One which was taken on one of our excursions was saddled upon an old moss-grown and decayed limb in a horizontal position, about 20 feet from the ground and was so remarkably shallow and so thoroughly incorporated with the bough that had the female not been on the nest it would certainly have escaped detection. The outside of the structure was built of lichen of exactly the same colour as that growing on the branch itself; it was lined with coarse grass and contained three eggs of a yellow cream colour, sparingly spotted towards the large end with light and dark brown.

Several large colonies of cliff or eave swallows (Petrochelidon lunifrons, Cabanis) have been observed in this vicinity. The nest of this species is very odd. It is constructed of small pellets of mud; and in its most perfect form it resembles a gourd; but when well protected by the overhanging eave of a building, the neck and sometimes part of the body of the nest is dispensed with.

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The markings of the eggs of the cliff swallow vary considerably, the spots on some specimens being fine and light yellow, while those on others are large and of a dark brown colour.

On one of the excursions the nest of a Brown Thrush (Harporhynchus cinereus, Baird,)—rather a rarity in this locality—was discovered, but too late to obtain specimens of the eggs as the young were already hatched.

Besides those already mentioned, a few of the rarer eggs secured on our excursions were those of the following birds:

American Redstart (Setophaga ruticilla, Swainson), Rose Breasted Grosbeak (Goniaphea Ludoviciana, Bowdich), Yellow Bellied Woodpecker (Sphyrapicus varius, Baird), Belted Kingfisher (Ceryle alcyon, Boie), Yellow Bellied Fly-catcher (Empidonax flaviventris, Baird), Whip-poor-will (Antrostomus vociferus, Bonapart), Night Hawk (Chordeiles Virginianus, Bonapart). It might also be mentioned that a nest of the Nashville Warbler (a great rarity) containing four eggs, was found on the 13th July last year in a secluded thicket in the corner of Dow's Swamp, a peat bog about a mile from the City. The nest was built of moss with a little hair inside, and was situated in the side of a small mound rising a few inches above the wet sphagnum moss by which it was surrounded.

The following is a list of birds, giving the dates at which they arrived in this vicinity in 1881 :—

Golden-eyed Duck (*Bucephala clangula*,) 17th March; American Robin (*Turdus migratorius*, Linnaeus) 31st March ; Blue Bird, (*Sialia sialis*, Haldeman,) 9th April ; Song Sparrow (*Melopiza melodia*, Baird,) 14th April ; White Crowned Sparrow (*Zonotrichia leucophrys*, Swainson,) 14th April ; White Bellied Swallow (*Tachycineta bicolor*, Cones,) 14th April ; Meadow Lark (*Sturnella magna*, Swainson,) 20th April ; Fish Hawk or Osprey (*Pandion Haliætus*, Savigny,) 22nd April ; Purple Martin (*Progne purpurea*, Boie), 22nd April ; Belted Kingfisher (*Ceryle Alcyon*, Boie,) 26th April ; Spotted Sandpiper (*Tringoides macularius*, Gray,) 5th May ; American Sparrow Hawk (*Falco sparverius*, Linnæus,) 5th May ; Ruby Throated Humming Bird (*Trochilus colubris*, Linnæus.) 9th May.

About the latter date the following warblers also arrived, Blue Yellow-backed, Maryland Yellow Throat, Black and White Creeper, Black Throated Green, Black Throated Blue, Yellow Rump, Bay Breasted, Blackburnian, Chestnut-sided, Yellow, Pine, Black and Yellow, and Red Start.

Rose Breasted Grosbeak (*Goniaphea Ludoviciana*, Bowdich,) 14th May ; Night Hawk (*Cordeiles Virginianus*, Bonapart,) 20th May. The Blackbirds and Sparrows had eggs in their nests on the 9th of May.

In conclusion it is sincerely hoped that next season the number of those taking an active part in the development of such interesting and important branches of Natural History as Ornithology and Oölogy may be largely increased and that the work done may grow proportionately in extent and utility.

GEO. R. WHITE,
W. L. SCOTT,

Leaders of the Ornithological and Oological Branch.

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APPENDIX.

List of Birds found in the vicinity of Ottawa City, specimens of which have been shot within the last few years.

("C." means common; "r.c." rather common; "r." rare. The numbers opposite to the species refer to Coues' Check-List of the Birds of North America.)

CLASS AVES.—BIRDS.

SUB-CLASS I. AVES AEREÆ OR INSESSORES, AERIAL BIRDS OR PERCHERS.

ORDER PASSERES, PERCHERS PROPER.

TURDIDÆ, THRUSHES.

1. *Turdus migratorius*, Linn. Robin, c.
4. " *pallasii*, Cab. Hermit Thrush, c.
6. " *fuscescens*, Steph. Wilson's Thrush, c.
9. *Mimus Carolinensis*, Gray. Catbird, c.
10. *Harporhynchus rufus*, Cab. Brown Thrush or Thrasher, r. c.
12. " *cinereus*, *Bd.* Cinereous Trush, r.

SAXICOLIDÆ, STONE-CHATS AND BLUEBIRDS.

16. *Sialia sialis*, Hald. Eastern Bluebird, c.

SYLVIIDÆ, SYLVIÆ.

21. *Regulus calendula*, Licht. Ruby-crowned Kinglet, c.
22. " *satrapa*, Licht. Golden-crowned Kinglet, c.
23. *Polioptila cærulea*, Sclater. Blue-gray Gnatcatcher, r.

PARIDÆ, TITMICE.

31. *Parus atricapillus*, Linn. Black-capped Chickadee, c.
34. " *rufescens*, Townsend. Chestnut-backed Chickadee, r.

SITTIDÆ, NUTHATCHES.

38. *Sitta Carolinensis*, Gmelin. White-bellied Nuthatch, c. (winter and summer).
39. " *Canadensis*, Linn. Red-bellied Nuthatch, c. (winter and summer).

CERTHIIDÆ, CREEPERS.

42. *Certhia familiaris*, Linn. Brown Creeper, c.

TROGLODYTIDÆ, WRENS.

49. *Troglodytes ædon*, Vieillot. House Wren, c.
50. *Anothura troglodytes*, Coues. Winter Wren, r.

ALAUDIDÆ, LARKS.

53. *Eremophila alpestris*, Boie. Horned or Shore Lark, c.

MOTACILLIDÆ, WAGTAILS.

55. *Anthus Ludovicianus*, Licht. Brown Lark, Titlark, Wagtail, Pipit, c.

SYLVICOLIDÆ, AMERICAN WARBLERS.

57. *Mniotilta varia*, Vieillot. Black and White Creeper, c.
58. *Parula Americana*, Bp. Blue, Yellow-backed Warbler.
67. *Helminthophaga ruficapilla*, Baird. Nashville Warbler, r.

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SYLVICOLIDÆ—AMERICAN WARBLERS.—*Continued.*

70. *Dendrœca æstiva*, Baird. Blue-eyed Yellow Warbler, Golden Warbler, Summer Yellowbird, c.
71. " *virens*, Baird. Black-throated Green Warbler, c.
76. " *cærulescens*, Baird. Black-throated Blue Warbler, c.
78. " *coronata*, Gray. Yellow-rumped Warbler, Yellow-crowned Warbler, Myrtle Bird, c.
80. " *Blackburniæ*, Baird. Blackburnian or Hemlock Warbler, r.
81. " *striata*, Baird. Black-poll Warbler, r.
82. " *castanea*, Baird. Bay-breasted or Autumnal Warbler, c.
83. " *Pennsylvanica*, Baird. Chestnut-sided Warbler, c.
84. " *maculosa*, Baird. Black and Yellow or Magnolia Warbler, c.
90. " *palmarum*, Baird. Yellow Red-poll or Palm Warbler, r.
91. " *pinus*, Baird. Pine or Pine-creeping Warbler, c.
92. *Seiurus aurocapillus*, Swain. Golden-crowned Thrush or Oven-bird, c.
97. *Geothlypis trichas*, Cab. Maryland Yellow-throat, c.
103. *Myiodioctes Canadensis*, Aud. Canadian Flycatcher, c.
104. *Setophaga ruticilla*, Swain. Redstart, c.

TANAGRIDÆ—TANAGERS.

107. *Pyranga rubra*, Vieillot. Scarlet Tanager, c.

HIRUNDINIDÆ—SWALLOWS.

111. *Hirundo horreorum*, Barton. Barn Swallow, c.
112. *Tachycineta bicolor*, Coues. White-bellied Swallow, c.
114. *Petrochelidon lunifrons*, Cab. Cliff or Eave Swallow, c.
115. *Cotyle riparia*, Boie. Bank Swallow, Sand Martin, c.
117. *Progne purpurea*, Boie. Purple Martin, c.

AMPELIDÆ—WAXWINGS, ETC.

118. *Ampelis garrulus*, Linn. Bohemian Waxwing, r. (Transient in latter part of winter.)
119. " *cedrorum*, Baird. Cedar or Cherry bird, c.

VIREONIDÆ—VIREOS OR GREENLETS.

122. *Vireo olivaceus*, Vieillot. Red-eyed Vireo, c.
132. " *pusillus*, Coues. Least Vireo, c.

LANIIDÆ—SHRIKES.

134. *Collurio borealis*, Baird. Great Northern Shrike, Butcher Bird, v. c.

FRINGILLIDÆ—FINCHES, ETC.

137. *Pinicola enucleator*, Vieillot. Pine Grosbeak, c. (First part of winter.)
139. *Carpodacus purpureus*, Gray. Purple Finch.
142. *Loxia leucoptera*, Wilson. White-winged Crossbill, r.
143. " *curvirostra*, L. var *Americana*, Coues. Red or Common Crossbill, c.
146. *Ægiothus linarius*, Cab. Red-poll Linnet, c.
149. *Chrysomitris tristis*, Bp. American Goldfinch or Thistle-bird, c.
152. *Plectrophanes nivalis*, Meyer. Snow Bunting, c. (winter.)
161. *Pooecetes gramineus*, Baird. Bay-winged Bunting, Grass-finch, c.
162. *Coturniculus passerinus*, Bp. Yellow-winged Sparrow, c.
168. *Melospiza palustris*, Baird. Swamp Sparrow, c.
169. " *melodia*, Baird. Song Sparrow, c.
174. *Junco hyemalis*, Sclater. Snow-bird, c.
177. *Spizella monticola*, Baird. Tree Sparrow, c.
178. " *socialis*, Bp. Chipping Sparrow, c.
179. " *pusilla*, Bp. Field Sparrow, c.

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FRINGILLIDÆ—FINCHES, ETC.—*Continued.*

182. *Zonotrichia albicollis*, Bp. White-throated Sparrow or Peabody-bird, c.
183. " *lencophrys*, Swain. White-crowned Sparrow, c.
187. *Passer domesticus*, Linn. English Sparrow, c.
193. *Goniaphea Ludoviciana*, Bowditch. Rose-breasted Grosbeak.
199. *Cyanospiza cyanea*, Baird. Indigo Bird.

ICTERIDÆ—AMERICAN STARLINGS.

210. *Dolichonyx oryzivorus*, Swain. Bobolink, c.
211. *Molothrus pecoris*, Swain. Cow-bird, c.
212. *Agelæus phœniceus*, Vieillot. Red-winged Black-bird, c.
214. *Sturnella magna*, Swain. Meadow Lark, c.
216. *Icterus Baltimore*, Dandin. Baltimore Oriole, c.
225. *Quiscalus purpureus*, Licht. Purple Grackle.

CORVIDÆ—CROWS, JAYS, ETC.

226. *Corvus corax*, Linn. Raven.
228. " *Americanus*, Aud. Crow, c.
234. *Cyanurus cristatus*, Swain. Blue Jay, c. (summer and winter resident.)
239. *Perisoreus Canadensis*, Bp. Canada Jay, Whiskey John (summer and winter resident.)

TYRANNIDÆ—FLYCATCHERS.

242. *Tyrannus Carolinensis*, Baird. King-bird, Bee-bird, c.
247. *Myiarchus crinitus*, Cab. Great-crested Flycatcher, r.
252. *Sayornis fuscus*, Baird. Peewee, Peewit, Phœbe, c.
255. *Contopus virens*, Cab. Wood Peewee, r.
258. *Empidonax minimus*, Baird. Least Flycatcher.

ORDER PICARIÆ—PICARIAN BIRDS.

CAPRIMULGIDÆ—GOATSUCKERS.

265. *Antrostomus vociferus*, Bp. Whip-poor-will, c.
267. *Chordeiles Virginianus*, Bp. Night Hawk, c.

CYPSELIDÆ—SWIFTS.

271. *Chætura pelasgia*, Stephens. Chimney Swift, c.

TROCHILIDÆ—HUMMING BIRDS.

275. *Trochilus colubris*, Linn. Ruby-throated Humming-bird, c.

ALCEDINIDÆ—KINGFISHERS.

286. *Ceryle alcyon*, Boie. Belted Kingfisher, c.

CUCULIDÆ—CUCKOOS.

290. *Coccyzus erythrophthalmus*, Baird. Black-billed Cuckoo, c.
291. " *Americanus*, Baird. Yellow-billed Cuckoo, c.

PICIDÆ—WOODPECKERS.

294. *Hylotomus pileatus*, Baird. Pileated Woodpecker, r.
298. *Picus villosus*, Linn. Hairy Woodpecker, c.
299. " *pubescens*, Linn. Downy Woodpecker, c.
300. *Picoides arcticus*, Gray. Black-backed Woodpecker, c. (in winter.)
302. *Sphyrapicus varius*, Baird. Yellow-bellied wookpecker, c.
309. *Melanerpes erythrocephalus*, Swain. Red-headed Woodpecker, c.
312. *Colaptes auratus*, Swain. Golden-winged Woodpecker, High-hole, Flicker, c.

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ORDER RAPTORES—BIRDS OF PREY.

STRIGIDÆ—OWLS.

317. *Bubo Virginianus*, Bp. Great-horned Owl, r.
323. *Syrnium nebulosum*, Gray. Barred Owl, c.
325. *Nyctea nivea*, Gray. Snowy Owl, c.
326. *Surnia ulula*, Bp. *var. Hudsonica*, Ridg. Hawk Owl, c.
328. *Nyctale Acadica*, Bp. Acadian or Saw-whet Owl.
329. *Glaucidium passerinum, var, Californicum*, Ridg. Pigmy Owl, r.

FALCONIDÆ—DIURNAL BIRDS OF PREY.

333. *Circus cyaneus*, Lacep. *var. Hudsonius*, Cs. Marsh Harrier, c.
337. *Nauclerus furcatus*, Vigors. Swallow-tailed Kite, r.
338. *Accipiter fuscus*, Bp. Sharp-skinned Hawk, r.
340. *Astur atricapillus*, Bp. Goshawk, r.
346. *Falco sparverius*, Linn. Sparrow Hawk, c.
360. *Pandion haliætus*, Savigny. Osprey, Fish Hawk, c.

ORDER COLUMBÆ—COLUMBINE BIRDS.

COLUMBIDÆ—PIGEONS.

370. *Ectopistes migratorius*, Swain. Wild Pigeon.

SUB-CLASS II.—AVES TERRESTRES OR CURSORES—TERRESTRIAL BIRDS.

ORDER GALLINÆ—GALLINACEOUS BIRDS.

TETRAONIDÆ—GROUSE, ETC.

380. *Tetrao Canadensis*, Linn. Canada Grouse or Spruce Partridge, r. c.
385. *Bonasa umbellus*, Stephens. Ruffed Grouse, Partridge, c.

ORDER GRALLATORES—WADING BIRDS.

CHARADRIIDÆ—PLOVER.

395. *Squatarola Helvetica*, Cuvier. Black-bellied Plover, Whistling Field-plover, c.
396. *Charadrius fulvus*, Gm. *var. Virginicus*, Cs. Golden Plover, c.
397. *Ægialitis vociferus*, Cassin. Kildeer Plover, r.
398. " *Wilsonius*, Cassin. Wilson's Plover, r.
399. " *semipalmatus*, Cab. Semipalmated, Ring or Ring-necked Plover

HÆMATOPODIDÆ—OYSTER-CATCHERS AND TURNSTONES.

406. *Strepsilas interpres*, Ill. Turnstone, Brown Bird, Calico-back, r.

PHALAROPODIDÆ—PHALAROPES.

409. *Steganopus Wilsonii*, Coues. Wilson's Phalarope, r.

SCOLOPACIDÆ—SNIPE, ETC.

412. *Philohela minor*, Gray. American Woodcock, Bog-sucker, c.
414. *Gallinago Wilsonii*, Bp. American or Wilson's Snipe, c.
415. *Macrorhamphus griseus*, Leach. Red-breasted or Grey Snipe, Brown-backed Dowitcher, r.
417. *Ereunetes pusillus*, Cass. Semipalmated Sandpiper, Peep, c.
418. *Tringa minutilla*, Vieillot. Least Sandpiper, Peep, c.

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SCOLAPACIDÆ—SNIPE, ETC.—*Continued.*

420. *Tringa maculata*, Vieillot. Pectoral Sandpiper, c.
424. " *Alpina*, Linn. *var. Americana*, Cass. Dunlin, Oxbird, c.
427. *Calidris arenaria*, Ill. Sanderling, Ruddy Plover, c.
429. *Limosa Hudsonica*, Swain. Black-tailed Godwit, c.
432. *Totanus melanoleucus*, Gmelin. Greater Tell-tale, Greater Yellow-shanks, c.
433. " *flavipes*, Gmelin. Lesser Tell-tale, Yellow-shanks, c.
435. " *solitarius*, Wils. Solitary Tattler, c.

ARDEIDÆ—HERONS.

449. *Ardea Herodias*, Linn. Great Blue Heron, c.
458. *Nyctiardea grisea*, Stephens, *var. nævia*, Allen. Night Heron, Qua-bird, c.
460. *Botaurus minor*, Gmelin. Bittern, Indian Hen, c.
461. *Ardetta exilis*, Gray. Least Bittern, r.

RALLIDÆ—RAILS, ETC.

468. *Porzana Carolina*, Vieillot. Carolina or Common Rail, c.
470. " *Jamaicensis*, Cass. Black Rail, c.
474. *Fulica Americana*, Gmelin. Coot, c.

SUB-CLASS III.—AVES AQUATICÆ OR NATATORES—AQUATIC BIRDS SWIMMERS.

ORDER LAMELLIROSTRES, ANSERINE BIRDS.

ANATIDÆ—GEESE, DUCKS, ETC.

485. *Branta Canadensis*, Linn. Canada Goose, c.
488. *Anas boschas*, Linn. Mallard, c.
489. " *obscura*, Gmelin. Dusky Duck, Black Duck, c.
490. *Dafila acuta*, Jenyns. Pintail, Sprigtail, c.
493. *Mareca Americana*, Stephens. American Widgeon, Baldpate, c.
495. *Querquedula Carolinensis*, Gmelin. Green-winged Teal, c.
496. " *discors*, Stephens. Blue-winged Teal, c.
499. *Aix sponsa*, Boie. Summer Duck, Wood Duck, c.
500. *Fuligula marila*, Stephens. Greater Scaup Duck, Raft Duck, c.
501. " *affinis*, Eyton. Lesser Scaup Duck, c.
502. " *collaris*, Bp. Ring-necked Duck, r.
503. " *ferina*, Swain, *var. Americana*, Coues. Redhead, Pochard, c.
504. " *vallisneria*, Stephens. Canvas-back Duck, r.
505. *Eucephala clangula*, Gray. Golden-eyed Duck, Garrot, c.
507. " *albeola*, Baird. Buffalo-headed Duck, Dipper, c.
508. *Harelda glacialis*, Leach. Long-tailed Duck, c.
516. *Œdemia Americana*, Swain. American Black Scoter, c.
517. " *fusca*, Swain. Velvet Scoter, c.
518. " *perspicillata*, Fleming. Surf Duck, r.
519. *Erismatura rubida*, Bp. Ruddy Duck, c.
521. *Mergus merganser*, Linn. Merganser, Goosander, c.
522. " *serrator*, Linn. Red-breasted Merganser, c.
523. " *cucullatus*, Linn. Hooded Merganser, c.

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ORDER LONGIPENNES—LONG-WINGED SWIMMERS.

LARIDÆ—GULLS, TERNS, ETC.

547. *Larus argentatus*, Brunn. Herring Gull, Common Gull, c.
554. " *atricilla*, Linn. Laughing or Black-head Gull, r. (only one specimen shot.)
555. " *Franklinii*, Rich. Bonaparte's Gull.

ORDER PYGOPODES—DIVING BIRDS.

COLYMBIDÆ—LOONS.

605. *Colymbus torquatus*, Brunn. Great Northern Diver, Loon, c.

PODICIPIDÆ—GREBES.

608. *Podiceps occidentalis*, Law. Western Grebe r. (a pair shot at the mouth of the North Nation River. Unfortunately the skins cannot now be produced, but there is no doubt as to their identity.)
609. " *cristatus*, Latham. Crested Grebe, c.
611. " *cornutus*, Latham. Horned Grebe, r.
614. *Podilymbus podiceps*, Law. Pied-billed Grebe, Dab-chick, Dipper, c.

From the above List it will be seen that 169 species of birds, belonging to 120 genera and 39 families, have so far been found in the vicinity of the City of Ottawa. Many names, however, will probably be added to the List in ensuing seasons.

SECOND SOIRÉE.

FRIDAY, DECEMBER 9TH, 1881. ON THE GEOLOGY OF THE OTTAWA PALÆOZOIC BASIN. BY ALFRED R. C. SELWYN, LL.D., F.R.S.

Having undertaken to say a few words, this evening, on the Geology of the country around Ottawa, I must preface these by stating that, never having myself more than locally and superficially examined the district, I can do little more than lay before you the results, so far as I understand them, of the investigations of others, and chiefly of those of my predecessor, Sir W. E. Logan, as described in the *Geology of Canada*, and as depicted on the Maps exhibited, and which are further illustrated by the collection now being arranged and exposed in the Geological Museum.

Though the *Geology of Canada* is accessible in a large number of the libraries of the colleges, schools, and public institutions of Canada, it is unfortunately now very difficult to obtain, and a new and enlarged edition is much needed. Whether regarded from an economic or from a scientific standpoint, this great work of Sir W. Logan and his colleagues must be considered a priceless gift to Canadian Geologists. Apart from theoretical deductions relating to structure, some of which will require to be changed or modified to accord with the result of more extended investigation, and our consequent more detailed knowledge of facts, it contains a mass of information, scientific and practical, which, however much future researches may enable us to supplement it, will always remain as a solid foundation on which the superstructure of Canadian geology must be built by

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succeeding generations. The geological map of Canada, which illustrates Sir W. Logan's work, is unfortunately even less widely known and distributed. It is rarely to be met with in any public institution, and I doubt whether more than 100 or 150 copies have ever found their way to Canada. Under these circumstances, and as there is not very much to be said in regard to the general palæozoic stratigraphy immediately around Ottawa, it will, perhaps, be more interesting if I attempt this evening to give a brief explanation of the main stratigraphical features of eastern Canada, as shown on the map, and point out some of the questions which seem to require for their final solution more careful and systematic investigation than they have yet received, work which must be done, however, not in the museum but in the field. If my observations are somewhat desultory I must ask you to bear in mind that I am not giving a lecture, but only an informal geological talk, and that I would much prefer not to have all the talk to myself, but to hear any remarks, observations, or suggestions that it may occur to the members of the Club to interpolate. With your permission I propose first to make some remarks on the subject of geological nomenclature, and to explain the sense in which I use certain terms, such as formation, system, series, &c., and also the use I propose to adopt in future for the names *Cambrian* and *Silurian*. The former, though perhaps the older of the two, is scarcely recognized by a large number of American geologists, and its use by the British Geological Survey has been restricted to certain strata, which probably correspond to the base of the Atlantic Coast series of Nova Scotia, and to the lowest of the palæozoic formation of the Ottawa valley. In January, 1836, Sir Roderick Murchison, in a communication to the Geological Society of London, gave an account of the origin of the terms Cambrian and Silurian. In 1836, the term Cambrian included all the formation below what Murchison had called Llandeils (*Calciferous* and *Chazy*), and he and Sedgwick supposed that the rocks of North Wales and south-western South Wales, which the latter was then studying, were older than the Llandeils, and to these the name Cambrian was assigned by Sedgwick; but later much of what had been included in Sedgwick's Cambrian turned out to be really not older than the Llandeils (Silurian of Murchison), and in this way came about the undue extension of the term Silurian, and the equally undue extinction of the term Cambrian. However, so long as we understand what is meant by the names when used the object is served, but it is very perplexing when every geologist uses them in a different sense, according as they are partizans of the one or the other of the eminent authors of the name. I am desirous, therefore, that in Canada at least some definite, and if possible uniform action should be established in this respect and also in the colours and notations of the Geological Survey, and with this object in view I have constructed the Index Chart which you see here, with some brief explanatory notes to accompany it. I propose to leave copies of these for reference by members of the Club, and if there are no very weighty objections against the proposed scheme, I hope it will be adopted in future by Canadian geologists, and I also hope that anyone who has objections to urge will come forward and state them, and in doing so will also be prepared to suggest the way in which the objection can be met and the scheme improved.

In speaking of the Ottawa valley I must not be understood to refer to the whole of the vast region, some 80,000 square miles, drained by the Ottawa and its tributaries, but only to the slightly undulating area, about 6,250 square miles, extending from the longitude of Montreal westward to Calumet, which is bounded on the north by the hills and ridges that form the southern slopes and spurs of the Laurentide Mountains, and on the south by the much more elevated peaks of the Adirondacks in the State of New York. These two hilly regions, entirely composed of ancient crystalline rocks, are connected on the south-west by a low ridge across which the St. Lawrence has found a passage from Lake Erie into the Ottawa valley and which now forms the picturesque scenery of the Thousand Islands. Proceeding eastward, to the vicinity of the Lake of the Two Mountains,

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we find they are connected by a similar ridge, but the rocks of which are here only exposed at the surface over a limited extent in the rear of the Indian Reserve at Oka, while the rest of this old ridge is concealed by a covering of flat lying strata of sandstone. Within these limits 125 miles long and about 50 miles wide lies what may be geologically described as the Ottawa Valley Palæozoic Basin.

This basin must, for immense periods of time have been occupied by the water of the ancient lower Palæozoic sea; whether continuously or with intervening periods of dry land is uncertain. Portions of it, however, were certainly, in its earlier stages, either shore lines or shallow tidal flats dry at low water, as evidenced by the tracks of animals and wind ripple marks, all of which you can see fine examples of in the Geological Museum. Slowly and gradually, however, the basin became filled by successive layers of sedimentary matter, pebbles, sand, mud, lime, forming the sandstone, shales and limestones which make up the so called Cambrian or Cambro-Silurian systems and formations.

Almost every layer of these ancient rocks is to the industrious geologist, aided by pick and hammer, as it were the pages of a voluminous work in which he can study and decipher the history, life habits, and surroundings of successive generations of animals and plants, similar though in no case identical with those which now inhabit our seas and continents.

The portions of this voluminous old manuscript which are presented for our perusal and study in the Ottawa Valley may be designated:

Vol. C.—Chapter 1 and 2.
Vol. D.—Chapter 1, 2, and 3,

otherwise known as:

C.—Cambrian System—Potsdam and Calciferous Formations.
D.—Cambro-Silurian System—Chazy: Black River; Trenton; Utica and Hudson River Formations.

The seven volumes from E to L inclusive, in which are written the records of millions of centuries, and of many generations of animals and plants, appear never to have been placed in the Ottawa Valley library, or else they have since been lost, stolen, or destroyed. Vol. M, the last of the series, is, however, to be found there in excellent preservation and offers many interesting and instructive pages. though its widespread occupation of the shelves often proves a serious hindrance to the study of the earlier volumes, and makes one wish it had shared the fate of the seven missing volumes referred to.

The names given to the formation are all taken from the localities in the State of New York where they were first studied by American geologists, and the names have been adopted by Sir W. Logan for Canada, with the addition, however, of three new and purely Canadian names, Levis, Lauzon, and Sillery, making what he has called the Quebec Group, at the same time stating that it represented the Calciferous and Chazy formations. Each of the formations I have named and which have together filled in the Ottawa basin to a depth in some parts of perhaps 1,500 or 2,000 feet, is supposed to be characterised by a peculiar and distinctive assemblage of life form, and the discovery of any of the individual species of these groups in an outcrop is sometimes held to be sufficient evidence for determining the formation to which the outcrop belongs. Such evidence is doubtless an invaluable aid to stratigraphy, but we must bear in mind that it is at best negative evidence, and it may be that some fossil which we have for a long time considered to be characteristic of a peculiar formation may suddenly be discovered in the strata either much higher or much lower in the series, and more especially is this likely to occur in new and only imperfectly examined regions. Too much reliance on imperfect palæontological evidence has, I think, led to many grave errors and complications in Canadian stratigraphy, and to needless multiplication of formations and groups, the introduction of which tends to complicate stratigraphical work. Often such formations represent only

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the locally varying character and conditions of deposition, and the consequent local differences in the life grouping within the areas in which the strata, notwithstanding their often great lithological diversity, were simultaneously laid down either along shore lines or in the bordering deeper waters. A formation which in one area is a limestone, in another not far removed, may be entirely formed of sand, or clay, or pebbles, and as a consequence, or from being a shallow or a deep water formation, contain an almost entirely different assemblage of fossils, and thus neither palæontology nor mineralogy, nor lithology, without careful and accurate stratigraphical work, will serve to determine the relative age of formations. All these local changes should, however, be carefully observed and noted, as they are often both practically and scientifically important, but they must be very cautiously used in the determination of the age of formations. Many amateur geologists go into the field, collect a number of specimens of the rock and fossils, some of them perhaps loose, and then on the evidence these afford attempt to determine the geological structure of the region examined. Dips and strikes are not recorded on a map, overlaps are mistaken for unconformity, and faults or folds causing repetition of strata are not observed, and thicknesses in consequence often greatly over-estimated. Again, not unfrequently theories are formed and facts carefully sought to support these, while the plain meaning of others adverse to the theories are either ignored or supposed to mean the very reverse of what they indicate. Though in a general way the structure of the Ottawa valley is pretty well known, there are many palæontological and structural details which remain to be worked out, and which offer in a comparatively limited and easily accessible area a highly interesting field of investigation, and it is to be regretted that the most essential requisite for the accomplishment of this work, viz., an accurate map on a sufficiently large scale, does not exist.

One most interesting question is that of overlap or unconformity, and which of these has produced the distribution of the formations as now observed in the Ottawa Valley. Overlap is frequently met with along the margin of formations deposited in tracts which were undergoing gradual submersion. As the land sank successive zones would be submerged, and the later deposits on the sea bed would be prolonged further and further beyond the limits of the earlier ones. This appears to have been the case in the Ottawa valley. But further careful investigation is required to enable us to determine how far the relation of the several formations from the Potsdam to the Hudson River are the result of faulting, of unconformity, or of overlap. Several considerable faults have already been indicated by Sir W. Logan. In an overlap the strata are parts of one continuous unbroken series the formation of which does not appear to have been interrupted by any great physical disturbance, only a quiet and equal subsidence of the land. But where the accumulation of a set of beds or strata has been succeeded by its elevation, exposure, and denudation, the next group of rocks laid down are said to lie unconformably on it. Now, in cases where the older rocks have been equally upraised and again after having been exposed to denudation, have been equally depressed, without being folded or tilted, and a newer set of rocks deposited on them, it is often exceedingly difficult to distinguish between this kind of unconformity and an overlap.

An unconformity is of the highest importance in the geological structure of a district, because it marks one of the greatest gaps or intervals in its history, and the observer should therefore spare no pains in collecting all available evidence of the existence of such a structure. Sir W. Logan says (in 1863) the Lower Silurian of Canada may be separated on palæontological grounds into two districts—an upper and a lower, or, as I propose to call them, a Cambrian and a Cambro-Silurian, and he puts the line or break at the base of the Black River—and, mark, not apparently on stratigraphical grounds, but on palæontological evidence, which was then imperfect. Stratigraphically there is no apparent unconformity between the Chazy and Black River, or between it and the Trenton. Later (in 1866) Mr. Billings says,

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but still reasoning entirely on palæontological evidence, "the Lower Silurian of America can be divided into two principal groups, one above the break at the base of the Chazy, and the other below. The former includes the Chazy, Black River, Trenton, Utica, and Hudson River formations. The lower comprises a series of formation which are only now begining to become known." Further, Mr. Billings says: "From the top of the Hudson River down to the base of the Black River limestone there is no break, but all is occupied by a single immense, highly characteristic and compact fauna. The lower, middle, and upper portions of this series or group, as I should call it, may be easily recognized by species peculiar to each, but the abundant and dominant forms are found throughout."

Between the Black River and Chazy there is a gap. These two formations are connected by about twenty-three (23) species. Now, as there are, according to Billings, only two species common to the Chazy and the Calciferous, therefore, on palæontological grounds, the break must be placed at the base of the Chazy. As I have already said, there is no stratigraphical break at the base of the Black River. What the structure indicates as between the Chazy and the Calciferous I am not prepared to say as I have never examined the junction line of these two formations. One of these lines appears to run from Grenville on the Ottawa in an irregular line to Coteau Landing on the St. Lawrence, and another from Gloucester and Metcalfe south of Ottawa to the vicinity of Edwardsburgh on the St. Lawrence, but apparently much uncertainty exists as to the precise nature of the junction of these two formations, and it would be both interesting and useful to have the two indicated boundaries carefully traced out and studied.

In my investigation of Canadian geology it has seemed to me most unfortunate that such a stratigraphical expert and careful observer as Sir W. Logan most undoubtedly was should have allowed his work to be so much influenced by chemico-mineralogical theories and imperfect palæontological evidence. Had he firmly held to the maxim of my old friend and colleague, J. Beete Jukes, late Director of the Irish Geological Survey, to the effect, as he expressed it, that if "the fossils did'nt agree with the rocks so much the worse for the fossils," he would probably have made no mistakes in the interpretation of the structure and the affinities either of the palæozoic rocks of Lake Superior or of the Quebec group, which latter, as it now stands depicted on the map, most certainly includes, not only parts of the whole of the Cambro-Silurian and Cambrian formations as developed in Eastern Canada, but also a very large area of strata which cannot be otherwise regarded than as of pre-Cambrian or Archæan Age, probably Huronian. I have roughly sketched out on this map the main structural features of the Quebec group region, but much laborious and careful work in the field is still needed before the probable limits and distribution of the several formations of the Cambrian and Cambro-Silurian systems can be laid down here as they have been on the north-west side of the St. Lawrence valley. This region, however, extending from the Vermont boundary to Gaspe, offers an inexhaustible field of study in all the most intricate problems of dynamical and of stratigraphical geology, and I hope some of our young geologist will, to use an expressive Americanism, "go for it." Another very interesting question is to be found in the determination of the limits of the ancient palæozoic sea, in which the deposits of the Ottawa valley were formed, and to what extent subsequent denudation has removed the records of its existence over the Laurentian high lands to the north of us. We already know of quite a number of small and now isolated patches or outliers. Lake St. John, Lake Abittibe, and the Allumette Islands, fifty miles up the Ottawa, and there may be a great many more in his great northern unexplored region. These should be carefully sought for, and we may yet find evidence to show that the now widely separated palæozoic basins of Winnipeg, Hudson Bay, and the St. Lawrence were once connected across the Laurentian Axis. At any rate, in theorising on these intricate questions we must constantly bear in mind the unstable nature of what we call the earth's

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crust, and in studying the results of *formation* and *deposition*, we must not ignore or forget the equally potent agencies of *denudation* and *destruction* without which latter the former could have no existence. These marvellous changes which the solid crust of our planet has undergone are graphically described in Tennyson's lines :

> "There rolls the deep where grew the tree;
> O Earth, what changes hast thou seen!
> There, where the long street roars, hath been
> The silence of the central sea.
>
> The hills are shadows, and they flow
> From form to form, and nothing stands,
> They melt like mist, the solid lands
> Like clouds they shape themselves and go."

The Secretary read a communication from Mr. H. M. Ami, entitled : "Notes on an exposure of the Potsdam Formation at Buckingham Basin, Lièvre River, Quebec," of which the following is a brief abstract :

After referring to the paucity of exposures of the Potsdam in this neighbourhood the paper described an outcrop occurring about one mile from the mouth of the Lièvre River, and consisting of a series of strata with a S. E. dip and a N. E. and S. W. strike, the angle of the dip being about 15°. The rock is a finely grained, or coarse sandstone or quartzite; many of the strata containing small rounded pebbles of quartz, especially abundant at the divisional planes. Some of the strata are of considerable thickness and may be valuable as building stone; the remainder are thin and disintegrate rapidly. They vary in colour from white to chocolate and blood-red. The total thickness of the section is estimated at about 44 feet, but of this only about 29 feet are visible, the remainder being below the water line. The series rests upon a bed of very coarse quartzite conglomerate, constituted of large smooth pebbles embedded in a matrix of *detritus* from the adjoining Laurentian rocks. There is little or no evidence of the presence of organic remains in these strata, except small cavities on the surface planes which are supposed to have sheltered sponge-like organisms. Even *scolithes*, so common in the Potsdam, was not found here. The surface of the exposure shows striæ, resembling those made by glaciers, having a S. by W. or S. S. W. direction, and ripple marks also occur in some places.

THIRD SOIRÉE.

FRIDAY, JANUARY 13, 1882.—FILTERINGS FROM THE WATER SUPPLY OF THE CITY OF OTTAWA. REV. A. F. KEMP, LL.D.

The water supply of cities and towns has everywhere become of the greatest importance to the public health. Water is not only a necessity of life, in its pure and simple state, but it may become the subtle medium of disease and death. It is a chemical solvent of many pernicious things, and even when most translucent may contain innumerable microscopic forms and germs of plants and animals that may become the virus of the most fatal diseases. It is well known that zymotic diseases are due in a great measure to the impurities in water, and that they become epidemic through water more than in any other

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way. The supply of pure water for public uses is thus a matter of first importance to every community.

It is now certain that wells, no matter how constructed and whether in city, town or country, cannot be depended on for purity. Surface drainage will, more or less, find its way into them and the more numerous the houses the more certain they are to be polluted. Hence the propriety of closing by law city and town wells and of obtaining by public works water of the maximum purity from large rivers or lakes. Where this has been done the public health has been promoted and the death rate diminished.

The purity of water may easily be determined by chemical analysis in so far as it depends on chemical elements, but something more than this is necessary to ascertain the precise character of its solid contents in which hurtful ingredients, may lurk. This is the work of the Naturalist, and until he has subjected these to minute examination we cannot be certain as to the character of our water supply. The water of the Ottawa River, from which this City obtains its supply, has been carefully analysed by the public Analyst, and his report, we are happy to know, so far as chemistry can determine, is very satisfactory. He informs us that it has a slight yellow colour and peaty odour, contains no Calcium or Chlorides or Phosphoric acid or Nitrates or Hydrates, a little Ammonia, only three and a half grains in the gallon of solids in solution and four and a half grains of solids in suspension with a fraction of Microcisms. Altogether we have an exceptionally good water, which ranks superior to what, in England, is reckoned as first class.

What we further want is a more particular knowledge of the solids in suspension and of the Microcisms. They amount, in the six samples examined, to about 4½ grains to the gallon of 70,000 grains; a small proportionate amount certainly and might be thought scarcely worth notice. But when we consider that most people use half a gallon of water every 24 hours and some a great deal more, it is obvious that the amount of its solid contents which we receive from day to day amounts to something, especially when we know that they may have great potency as deleterious germs. It may therefore be important to discover their precise character. This can only be done by the aid of the microscope, as, for the most part, they are quite invisible to the naked eye.

The simplest way to obtain this material is by attaching a bag of ordinary cotton cloth to the water tap and allowing the water to run freely through it for a few hours. The cloth is then washed in a conical glass and the solid matters allowed to settle. A great part of the water is then poured off leaving only sufficient for moisture. The material can then be easily transferred to strips of glass and covered for inspection. These filterings require to be frequently gathered, more particularly in spring and summer. Winter filterings contain few living forms and are chiefly remarkable for fragments of rotted leaves and frustules of diatoms. It was late in the summer before I began to take filterings; the best time was consequently past, and I suspect I have only secured a fraction of what might be got. On the whole I have noted about 140 forms of animals and vegetables, some being very abundant and some rare. The animals belong to the sub-kingdoms of the Articulata and Protozoa. My largest catch was a Hirudo medicinalis, or common leech, about 1½ inches long. Of the family of the Brachionæa there are three species, and curious creatures they are. They have a lorica like a turtle with horns and forked feet, a single rudimentary eye, and a kind of nervous system; also teeth, and a mouth with long ciliæ or bristles which when in rapid motion have the appearance of a wheel. They are male and female, have one kind of egg for the male and another for the female, and a third or resting spore for the winter.

Of Rotifers I found five different species. Eugena viridis were abundant with crowds of minute vibratile spores doubtless of both plants and animals, but impossible to determine. Specially to be noted were the numerous and beautiful silicious spicules of the Spongidæ, which I reckon to belong to three distinct

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species. These curious animals are very abundant in the quiet bays of the Ottawa, especially where there are decayed logs or wood of any kind. They are neither pleasant to smell nor taste and are accused of giving the Croton water of Boston a peculiar cucumber flavour. Happily so far as we know they are not poisonous, although they readily become putrid; but as there is so much flow in our river its water is not likely to be affected either with their odour or taste. They are wonderful creatures; their development from the spore to the perfect form and the formation of their curious spicules are among the mysteries of nature. They constitute a colony of what is called flagellato-ciliated monads.

Passing now to the vegetable kingdom, the sub-kingdom of the Algæ and the family of the Diatomaceæ demands the first attention. These remarkable and beautiful forms lie on the borders of the two kingdoms animal and vegetable. They float free and have no roots; most of them are solitary but many are social. I have found fifty different species and suppose that three times fifty might easily be obtained. Most of them I have been able to identify and they comprise species of over twenty genera, none of them uncommon, but the individuals of some are very numerous.

The beautiful bright green Desmidiaceæ were also numerous; Cosmarium and Pediastrum, occurring in their various brilliant forms, most of which I have been able to identify.

Of the Algæ proper I have noted about 50 species of the globular and filamentous kinds, Oscettariæ, Confervæ and Conjugatæ being very abundant. The smaller species of this order that border on the fungus tribe and can scarcely be distinguished from them are not wanting, such as Bacteria, Bacillus and Vibrios, the species of which are doubtful and indeterminate. They are however the *mauvais sujets* of the Kingdom, accused of poisoning our blood, infecting us with deadly diseases, acidulating our milk, converting cider and wine into vinegar, sweet must into bad whiskey, and with moisture hastening the destruction of all animal and vegetable tissues. The living sporules of these useful and pernicious plants swim in our waters, infest our teeth, grow like a forest in our throats, and like invisible agents of the wicked one play on us fantastic tricks.

Finally I have found fragments of all sorts of leaves mashed into indistinguishable pulp, and frequently covered with parasitic algæ; also quantities of silicious dust and some fragments of marble, with some fantastic things for which I have no name.

What effect these things have on the salubrity of our water it is hard to say. That they are impurities that it would be better without, is certain. Many of them are not in themselves hurtful, only they might afford favourable conditions for the development of hurtful things. They make it manifest however that water, even in its best obtainable form, is an agent by which invisible and even indiscoverable germs of potent poisons may be transmitted from place to place and from great distances, to the detriment of human life. The Naturalist who traffics among these atoms of life can say with a warning voice that he finds the most favourable conditions for their existence and increase in waters polluted more or less by sewage, and putrid animal and vegetable matters. If citizens and statesmen will listen to the voice of Science, they will do their utmost to prevent the pollution of the sources of our water supply. Cities, towns and villages, and even farms on the banks of great rivers and lakes, should, under pains and penalties, be prevented from draining sewage into them. The immense quantity of sawdust and chips that are thrown into the Ottawa, along a great part of its course, are undoubted sources of pollution, and furnish favourable conditions for the development of various ferments. How to keep sewage and waste out of our rivers is a puzzling problem. It is taxing the wits of the best men in England, and it will puzzle us too. We may be awakened to the necessity of it when it is too late The maximum purity of our water will not save us from the injurious effects of the living things that infest it.

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LIST OF FINDINGS.

ARTICULATA.

Hirudinea.

Hirudo Medicinalis, a common Leech.

Phytozoa and Protozoa.

Euglenia viridis.
Vorticella microstoma.
" rotatoria.
Nassula elegans.
Brachionus militaris.
" dorcas.
" urceolaris.
Scaridium longicauda.
Cyctoglena lupus.
Euchlanis triquetra.
Rotifer vulgaris.

CRYPTOGAMIC VEGETATION—ALGÆ.

Desmidiaceæ.

Desmidium Swartzii.
Cosmarium parvulum.
" cucumis.
Closterium rostratum.
Pediastrum tetras.
" rotula.
" selenæa.
" boryanum.
" Ehrenbergii.

Diatomaceæ.

Epithemia sorex.
" turgida.
" gibba.
" granulata.
Cymbella cuspidata.
" gastroides.
Amphora costata.
Cocconeis Placentula.
Cyclotella Rotula.
" operculata.

Diatomaceæ.—Continued.

Surirella ovata.
Tryblionella angustata.
Nitzschia linearis.
" tenuis.
Amphipleura pellucida.
Navicula cuspidata.
" serians.
" ambigua.
Pinnularia major.
Synedra ulna.
" radians.
" acicularis.
" obtusa.
Gomphonema constrictum.
" acuminatum.
" apiculatum.
Odontidium tabellaria.
" mutabile.
" Harrisonii.
Fragillaria capucina.
" mutabilis.
" undata.
" virescens.
Achnomthidium coarctatum.
" lanceolatum.
Striatella unipunctata.
Tetracyclus lacustris.
Diatoma vulgare.
" hyalinum.
" granda.
" elongata.
Tabellaria flocculosa.
" fenestra.
Melosira ovichalcea.
" sulcata.
Orthosira punctata.
Asterionella formosa.
Stephanodiscus ægypticus.
Raphanus rhombus.

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Plate fig. 45
to face

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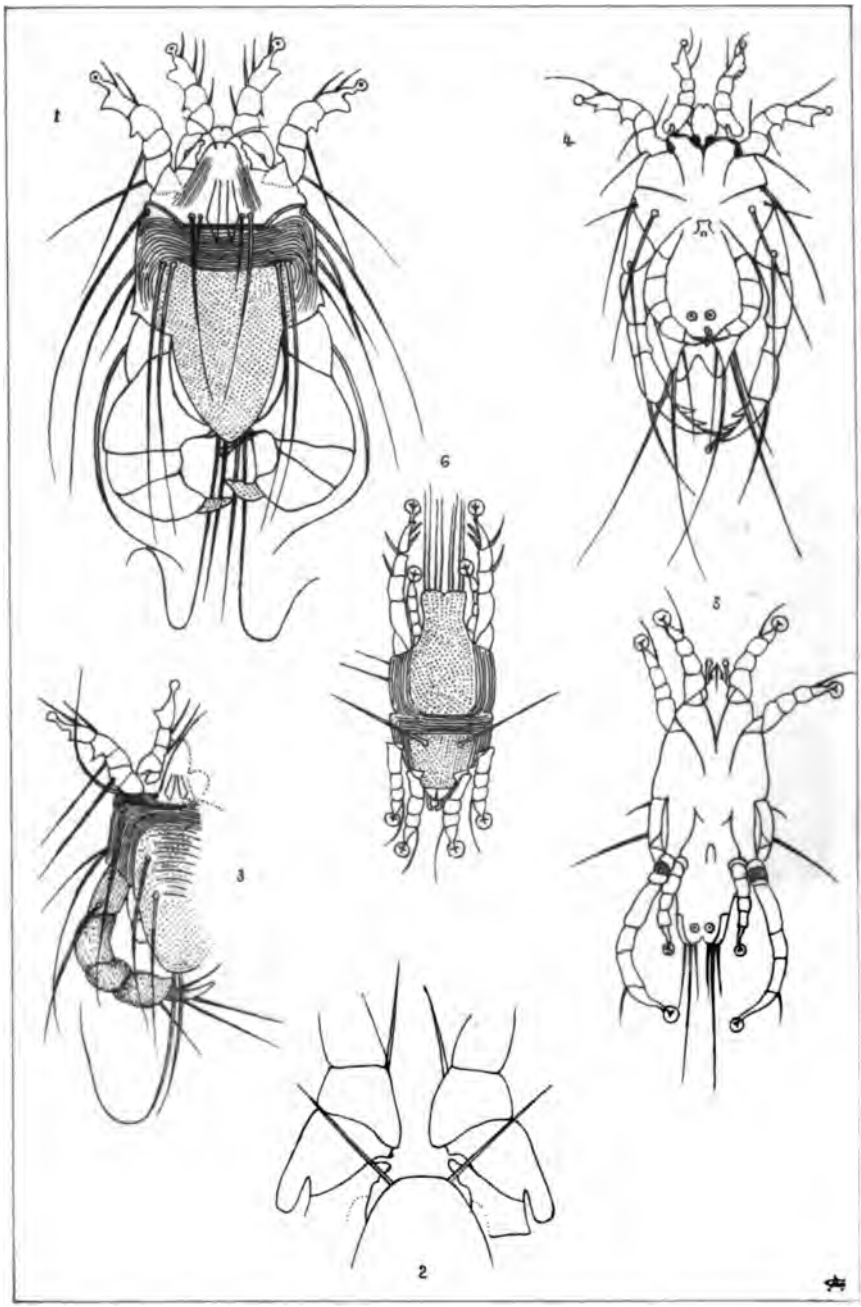

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FOURTH SOIRÉE.

FRIDAY FEBRUARY 10, 1882.—HOUSE-FLIES—W. H. HARRINGTON.

A Paper descriptive of the appearance and habits of the Common House-fly (Musca domestica), in its various stages.

ON SOME CANADIAN ECTOPARASITIC SARCOPTIDÆ—J. B. TYRRELL, B.A.

The species described in the following paper were collected by my brother' Mr. H. E. Tyrrell, and myself, from some of our common Canadian birds.

M.M. Ch. Robin and Meguin give the following general characters for the Sarcoptidæ :*

"Animals greyish or reddish, very small (varying in length from one-tenth of a millimetre to about a millimetre), body soft, without a dorsal shield, and without eyes or respiratory stigmata ; with a rostrum provided with very small unarmed jaws, carrying lateral, often large maxillary palps with three joints, furnished with from one to three hairs, joined along a part of the inner border to a membranous lip, which is shorter than the mandibles and carries two hairs on its lower surface, and a lance-like little tongue on its upper. The five-jointed feet arranged in two groups of two pairs each, placed, the one near the head, the other after a considerable intervening space near the abdomen, the tarsus terminated by a cup-like cushion furnished with claws, or by a sucker with or without a claw, at least on the anterior feet, and these (suckers) may be pedicelled or not, though they are wanting in the adult females of some species."

The family above described includes among others the ectoparasitic forms of which we are treating. They were originally included by Koch in his genus Dermaleichus, which now, however, ranks as a sub-family, including some ten or twelve genera within its bounds.

We might here run over shortly the structure of the animals belonging to this group.

The general outline of the body is oval or oblong, more or less elongated, with the rostrum projecting from the anterior end. This latter, as has been lately shown by Dr. G. Haller † is composed of the following parts : an epistome, which is simply a prolongation of the skin of the dorsal surface stretching forward and bending downwards on each side, thus covering the other mouth-parts above and on the sides. Beneath this are situated the triangular unarmed mandibles, which project a little beyond the front of the epistome. Under, and stretching behind the mandibles into the body cavity, are seen the first pair of maxillæ, bearing on their outer and upper side the three jointed palps. The rudimentary second pair of maxillæ lie under the first, and under them lies the lower lip, sometimes considerably extended. The alimentary canal commencing at the mouth runs backwards for a short distance, then dilates into quite a wide stomach, again contracts and runs backwards as a rather narrow tube to open by an anus at the posterior end of the body. Salivary glands are situated on each side of the œsophagus and open by ducts into the front of the gullet between the mandibles. Dr. Haller considers that some of the cells of the stomach serve the purpose of a liver, but otherwise no distinct liver has been detected. The nervous system consists of a ganglion situated above the œsophagus, but up to the present I have not been able to make out any nerves coming from it, though no doubt such exist.

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* *Journal de l'Anat*, 1877, *p.* 213.
† Zeit. fir Wissen. Zool., Band xxxvi.

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The male sexual organs consist of a pair of testicles lying in the body between the insertion of the fourth pair of extremities; from these proceed vasa deferentia, which carry the spermatozoa to a vesicula seminalis, situated between the testicles; beneath this lies the genital plain, bounded in front, as a rule, by a strong curved band of chitin and bearing a penis, which may be long or short, and either soft or chitinous. As accessory reproductive organs may be mentioned the copulatory suckers on the ventral surface of the abdomen, and in some genera the enlarged third extremities, which are then used as claspers.

The female sexual organs consist of a post-anal opening leading by a tube into a receptaculum seminis which opens into the anterior end of the oviduct. The ovaries are two irregular masses lying near the posterior end of the body, and opening at their anterior end immediately into the wide oviduct, which is very often seen to contain a relatively large egg. The oviduct opens between or in front of the insertion of the third pair of extremities by a longitudinal slit which is protected by a thin chitinous plate on each side, and in front by a dark brown chitinous bow called the shemit or lyra.

The surface of the body is covered with a thin chitinous cuticle which on the belly and sides and across the middle of the cephalo-thorax is marked with fine folds like those seen on the palm of the hand. The back in adult specimens, in some species, with the exception of the part above mentioned, is covered by two slightly darker, finely granular plates, one over the anterior portion and jaws, the other over the abdomen and hinder part of the cephalo-thorax. The epimera, as the dark brown bands of chitin are called which run in from the insertion of the feet and support them, constitute the whole skeleton. Chitinous hairs and bristles are scattered regularly over the body, being disposed as anterior and posterior dorsals, laterals, and anals, together with others on the body and extremities. As they appear to be of definite number, size, and position, in the different forms they are of great importance in defining the species. The extremities are in two pairs on each side, the anterior being situated on the anterior end of the body, and alike in males and females. The third and fourth pair, on the contrary, are situated rather far back, and usually different in the two sexes. In some of the genera the third pair of extremities is greatly enlarged, forming large claspers, and they are then no longer used for locomotion but only in copulation.

The different stages of growth are as follows: First the egg, about twice as long as thick, and rounded at each end. Second, the hexapod larva, and, as shown by M.M. Robin and Meguin,* it is, curiously enough, the third and not the fourth pair of legs which has not yet appeared. Third, after the larval state these little animals acquire the possession of eight legs, but otherwise are much the same as before, no sexual organs up to this time being developed. This condition has been called the nymph stage. Fourth, after the next moult the males assume their mature form; the females have to pass through another stage before they come to sexual maturity. In this stage they are a little larger than the nymphs, but otherwise differ very slightly from them. Fifth, In females the complete sexual development, an egg being usually seen to be present in the oviduct. It is only in the mature stages that the plate on the dorsal surface of the abdomen is present in those species which possess it; in the earlier stages it is always absent.

Habitat.—They live among the feathers of most of our birds, being found on the wings in living and recently killed specimens, but on birds that have become stiff and cold generally close to the body, where they may sometimes be found for four or five days after death.

ANALGES, Nitzsch, 1819.

General form of the body very different in the two sexes, the third pair of extremities being greatly enlarged and terminated by strong claws. The fourth

* *Journal de l'Anat et de la Physiol.*, 1877, p. 233.

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extremity is comparatively small and inserted towards the median line from the third. The first pair has a strong olecranon process on the postero lateral angle of the second joint, and this may or may not be present on the corresponding joint of the second pair of legs; also, strong thorn-like spines project from the outer side of the fourth and fifth joints of these two pairs of legs. The abdomen, which in males is much narrower than the cephalo-thorax, has its posterior border simply rounded.

Analges passerinus, De Geer. This species has been found on Dolichonyx oryzivorus, Junco hyemalis, Spizella socialis, and Sayornis fuscus.

Analges fringillarum, Koch., has been found on Goniaphia ludoviciana, and Empidonax flaviventris.

Analges tridentulatus, Haller., on the Horned Lark, Eremophila alpestris.

Analges digitatus, Haller, on Dendrœca striata and Sitta Carolinensis.

ANALGES LONGISPINOSUS, n. sp.

FIGS. 1 & 2, PLATE I.

Male.—The general shape of the body is long ovate, with the obtuse end turned towards the front. A chitinous band runs across the back almost immediately behind the second pair of legs. The side of the body between the insertions of the second and third pairs somewhat longer than the width of the abdomen, the length of which is considerably less than the distance from the base of the rostrum to the insertion of the third pair of extremities.

On the first extremity, on the second joint, the olecranon process is largely developed, and the anterior angle of the inner side projects forwards and inwards, meeting the downwardly projecting posterior angle of the fourth joint, and forming with it a nipper-like organ as shown in fig. 2. On the second extremity it is scarcely noticeable. The external process on the fourth joint in both is small and directed backwards, but on the fifth it is quite large and strong. The enormous third extremities, however, are what first attract the attention. The first joint or haunch is large and separated by an oblique line of junction from the second, which is very large, bearing on its inner side a long curved blunt process which forms with the fifth joint a powerful nipper. The last joint or tarsus is small and bears on the inner side at its base a little blunt tooth which runs out into a fine hair.

The fourth extremities are inserted on the ventral surface towards the centre line from the point of attachment of the third, and lie in a longitudinally striated groove under the border of the abdomen, reaching considerably beyond its posterior end when stretched out to their full extent.

The bristles are mostly long and stout. The anterior laterals are a little distance behind the insertion of the second pair of legs, with the anterior dorsals towards the middle line from them, two in number, one on each side, the inner one being very small. The posterior dorsals are large, two on each side, with the posterior laterals near them on the edge of the body. End bristles three in number on each side, the centre one being much the largest. Length of body ·45 mm., breadth ·26 mm.

The female is considerably larger than the male, the relation of the length to the breadth being about 12 to 5. The posterior pairs of extremities are small and situated about the middle of the lateral surface of the body.

This species is closely allied to *A. Nitzschii*, Haller. It is found in considerable numbers on the Snow Bunting—Plectrophanes nivalis.

ANALGES TYRRANNI, n. sp.

FIG. 3. PL. I.

Male.—General shape more or less obovate, with a length of ·32 mm. and a breadth of ·19 mm.; abdomen a little longer than the side of the cephalo-thorax,

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and about two-thirds as long as its width. The chitinous band across the back bends round at the sides, and on the belly runs backwards and inwards, reaching down almost to the sexual opening, which has a peculiar guard formed by the sternite or chitinous bow in front of the sexual plate, joining at both ends with the epimera of the fourth pair of extremities. The epimera of the first pair join in a point behind the rostrum.

The first pair of extremities has the olecranon process on the second joint large, the spine on the fourth aborted, that on the fifth well developed. On the second extremity the olecranon is absent, the spines on the fourth and fifth joints strong. The first joint is something the shape of an equilateral triangle, an angle barely reaching the outer side of the leg. The third extremity is long, with the first four joints of about equal width, the fourth being, perhaps, slightly the widest; the fifth is small but bears a long curved claw. The finger-like process present in the closely allied species A. *digitatus* is here absent. The fourth pair of extremities long, stretching when extended considerably beyond the posterior end of the abdomen.

The position of the two long posterior dorsal bristles is peculiar. Instead of arising close beside each other, as in most species, they are inserted one behind the other, about ·06 mm. apart, the hinder one being a little nearer the middle line of the body than the other and immediately between the points of insertion of the fourth pair of extremities. The posterior bristles are present three in number on each side, the two inner ones on each side being rather long.

Female.—Larger than the male, being ·38 mm. long and ·17 broad. It can easily be distinguished by the strong olecranon process on the first extremity and by the eight comparatively strong bristles on the dorsal surface. It is found on the King bird—Tyrannus Carolinensis.

DIMORPHUS, Haller, 1878.

"Third pair of feet enlarged, always without claws, but with sucking disks; the first two pairs but seldom with olecranon process, always with more or less projecting spiny processes. Abdomen with the posterior end always deeply indented."

Dimorphus aculeatus, Haller. This species was found on the Bluejay—Cyanurus cristatus.

Dimorphus Tyrellii, Haller., was found on the Catbird—Mimus Carolinensis.

Dimorphus gladiator, Haller., was found on our common wild pigeon—Ectopistes migratorius.

Dimorphus forcipatus, Haller., was found on the spotted sandpiper—Tringoides macularius, and on the white-rumped sandpiper—Tringa Bonapartei.

Dimorphus pici majoris, Buchholz, was found on the Big Sapsucker—Picus villosus.

DIMORPHUS ALBIDUS, n. sp.

Fig. 4. Pl. 1.

Male.—General shape of the body somewhat oval with a length of ·38 mm., and a breadth of ·19 mm. The abdomen about as long as the breadth of the body, and about three times as long as the distance between the second and third extremities. The epimera are long and strongly coloured, those of the first pair of extremities joining very near the front and running back in a long point; between the fourth pair the inconspicuous sexual opening is situated. The copulatory suckers are situated a little more than half way back on the abdomen, which is rather deeply indented, the hindermost part appearing as a clear film. On each side are five bristles, the second and third from the middle being much the largest.

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On the first pair of extremities the olecranon process on the second joint is long and stout. The spine on the fourth joint is small, that on the fifth large. The third extremity is long and rather slender, the first joint being the broadest and armed about the middle of the under side with a long fine hair. The postero-lateral angle of the fourth joint is extended into a long strong bristle and another though somewhat weaker one arises from about the middle of the inner side of the same joint. The fifth joint is slightly longer than the fourth, bending inwards and tapering to a point which bears a sucking disk. On its inner side are present two blade-like bristles, one behind the other, very much as in *D. gladiator*, but on the short fourth extremity the blunt knobs or teeth so conspicuous in the latter species are here absent.

The female is about as large as the male, being ·39 mm. long and ·17 mm. broad. Its shape is somewhat oblong oval, the anterior part of the body being much the same as in the male.

It is found on the White-breasted Swallow—Tachycineta bicolor.

PTERONYSSUS, Ch. Robin, 1877.

Body elongated; sides straight with a marked indentation between the second and third pairs of feet. A little way in front of the third extremity, a long lateral hair takes its origin, with a short bristle just behind it.

The anterior pairs of feet are without either olecranon process or spines. The third pair in males is enlarged, and the abdomen is small and only slightly indented at its posterior end. In the females also, as in the two genera already mentioned, the abdomen is undivided, and is without appendages other than hairs.

Pteronyssus simplex, Haller, is found on the Red-headed Woodpecker—Melanerpes erythrocephalus.

PTERONYSSUS SPECIOSUS, n. sp.

FIG. 5, PL. I.

Male.—The general shape is that of a long oval with the dark brown chitinous epimera standing out in strong relief on the light coloured body, those of the first pair of legs meeting some distance behind the rostrum at an acute angle. The body is about ·54 mm. long and ·22 mm. broad. The abdomen is short, about ·12 mm. long, which is about half as long as the side of the body between the second and third pairs of legs.

On each side, running from the notch on the side of the cephalo-thorax to the insertion of the third extremity are two strong dark brown bands of chitin, the outer one bearing about the middle of its length a small dagger-shaped bristle; laterally from this again a fine, rather long, hair takes its origin.

The posterior end of the abdomen is in the shape of two small semi-circles meeting in the middle line, and each bearing three bristles, the middle one on each side being about half as long as the body. The copulatory arches are situated close to the posterior end.

The first extremity is situated on the anterior end of the body close beside the rostrum, and is slightly stouter than the second, which is inserted toward the side from, and about ·03 mm. behind, it. The third is long, with the first four joints of about equal thickness; and the fifth conical, with the sucking disk attached slightly outwards from its point. The fourth extremity is about half as long as the third and inserted immediately toward the middle line from it. All are provided with very large sucking disks.

The female is of a very regular long-oval shape slightly truncated at the posterior end, and of about the same size as the male, but with the third and fourth extremities of nearly equal size and inserted about ·09 mm. apart.

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Lyra situated just behind the line joining the notches on the sides of the cephalo-thorax, large and of a more or less square form.

This species is closely allied to *Pt. oblongus*, Buchholz. It is found, along with other forms, on the Big Sap-sucker—Picus villosus.

PTERONYSSUS FUSCUS, n. sp.

FIG. 6, PL. E.

Male.—The body is of a somewhat rectangular shape, contracted at the insertion of the third pair of extremities, so that the abdomen is only about half the breadth of the thorax. The total length is about ·38 mm, breadth ·19 mm., length of abdomen ·11 mm., distance between the second and third pairs of feet ·15 mm.

The two anterior pairs of extremities are rather slender and of about equal diameter throughout. The first joint is triangular, and the second articulated to one of the sides by its inner surface, leaving the truncated posterior end of the joint free, thus giving a peculiar shouldered appearance to these two front pairs of legs.

The third extremity is long, with the second, third and fourth joints of about equal diameter, the first slightly thicker, and the fifth in the shape of a somewhat bent cone with the sucker attached a little to the outside of the point. Two short blade-like bristles are attached, one behind the other, on the inside of this joint, very like those in *Dimorphus albidus*. The fourth extremity is simple and a little longer than the abdomen.

The epimera of the first pair of legs converge, but do not meet in a point. The bristle in front of of the insertion of the third extremity is rather slender, and assumes almost the appearance of a hair. The abdomen is rather deeply indented and furnished on each side with four end bristles. The copulatory suckers are close to the posterior end.

The female is considerably larger than the male, being about ·46 mm. long and ·18 mm. broad. It is of a somewhat oblong-oval shape, truncated at the posterior extremity.

It is found on the White-breasted Swallow—Tachycineta bicolor.

FIFTH SOIRÉE.

FRIDAY, MARCH 10, 1882.—NOTES ON THE OTTAWA UNIONIDÆ. F. R. LATCHFORD.

The family of lamellibranch mollusks known as the Unionidæ is represented in every part of the world, but with a very irregular distribution. While only ten species are found in Europe, fewer still in Africa and about eighty in Asia and the Islands of the Pacific, over five hundred have been described from North America. More than a hundred of these occur in the drainage of the Ohio alone; and in Georgia, the Ca olinas, Alabama, and the Southern and South-Western States in general, almost every stream has its peculiar forms. Towards the north and east the species become fewer and fewer, until only eleven are found in Massachu·etts. In Canada a much greater number has been met with by Messrs. D'Urban, Bell, Billings and Whiteaves, including several species introduced from the Western States through the great lakes and other avenues of water communication. In a paper read before the Field-Naturalists' Club in 1880, Mr. Heron noted twelve species from the vicinity of Ottawa, but at least twice as many are to be met with here, within a radius of forty miles. The very low state of the wa er in 1881 afforded me for collecting specimens of the Unionidæ

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facilities of which I had ample leisure to avail myself during the midsummer vacations. I have in my spare time since then studied carefully these humble creatures; and, not content with my own determinations, have take much pains to have the species collected identified by the best authorities. All have been checked or named by such eminent conchologists as Mr. Arthur F. Gray, of Danversport, Mass, Mr. Geo. W. Tryon, of the Academy of Sciences, Philadelphia, and Prof. J. F. Whiteaves, F.G.S., of the Geological Survey of Canada. I am therefore morally certain that, except perhaps in one or two instances, the shells which I found have been correctly determined.

The species met with belong to the genera *Unio*, *Margaritana*, and *Anodonta*. These are distinguished from one another more by the conformation of their shells than by any peculiarities of the animals themselves. Hence it is of the shells alone that most works on the *Unionidæ* treat; and from this course it is not my intention to depart at present. The shell itself will always enable the student to distinguish one species from another. But the soft parts are by no means undeserving of attention. In species of the same group they are very much alike. In species of different groups, for instance in *U. rectus* and *U. occidens*, they are so dissimilar that the least practised eye can perceive differences in their form and arrangement. In all cases they present the same admirable ordination of structure to purpose that we see elsewhere throughout the works of nature's God. Even the distribution of the Unionidæ is provided for, by their young being for a time endowed with hooks by which they can attach themselves to contiguous objects, often a fish or a water-bird, and be transported far from their place of birth. In the winter and spring the young, having already well formed shells, are extruded from the branchial uterus of the females in hundreds of thousands and even millions. According to a computation made by Dr. Isaac Lea, of Philadelphia, who has during fifty years studied the Unionidæ, and described almost half the species known, a large specimen of *U. Multiplicatus*, Lea, contained upward of three millions of embryonic young. Nearly all perish early in their free life, being devoured by fishes, crustaceans and the larvæ of many kinds of insects. Few, accordingly, attain maturity, which is reached in from six to ten years. Their food consists of animalculæ, which the water flowing in through the branchial orifice conveys to the mouth, at the same time that it supplies oxygen to the lamelliform gills.

Of the species found in the vicinity of Ottawa the first to be noticed belong to the genus *Unio*. Shells of this genus are readily distinguishable from those of the genera *Margaritana* and *Anodonta*, by their having both cardinal and lateral teeth. The genus, according to Jeffrys, was established by Phillippson in 1788; but it is generally attributed to Retz, who was chairman of the meeting at which Phillippson read his essay *sistens Nova Testaceorum Genera*.

Unio complanatus, Solander, is abundant in almost all our streams and lakes, and is subject to much variation in size and colouring. What may be regarded as the typical form is common in the Rideau everywhere and in the Ottawa above the Chaudière Falls. It is a moderately thin, brown, depressed, sub-rhomboidal shell, with a nacre of different and often of exceedingly beautiful shades of purple The average dimensions of ten shells, five from each river, are as follows: length 3·5 in., height 1·7, diameter 0·8.

In company with the typical form, I found near Skead's Mills, in 1880, a specimen of a small variety which is of considerable interest. Although presenting every appearance of maturity, it is only an inch in height by two and a half in length. For its size it is very thick and regularly inflated. I am informed that a similar variety occurs in some streams in Western New York.

A form almost as small is found in the cold and limpid waters of Meech's Lake. But it is a thin and not a thick shell; not inflated but depressed. Its colour is a very light brown.

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About half a mile from Meech's Lake, on the creek through which it finds an outlet, are a few shallow ponds, with a bottom of coarse sand and gravel washed down from the surrounding hills. In the warmer water of these ponds, where food also must be more abundant, *U. complanatus* is three times as large as in the neighbouring lake. It differs moreover in being proportionately less depressed, and more equally rounded at both extremities. Its colour is a rich dark brown with a silken lustre, and, not unfrequently, a tinge of bright orange along the umbonial slope.

Near Kettle Island there occurs a form of much interest on account of its curious angular inflation. How extraordinary this is for a species whose most constant characteristic is its flatness, may be inferred from the fact that a representative specimen whose height is 1·6 in. measures 1·5 in. in diameter. The inflation is greatest near the dorsal margin behind the hinge-ligament, where a section of the shell would be an almost perfectly equilateral triangle with the base and the angles at the base slightly rounded. A specimen found by Mr. Poirier is 3 in. high, 4·9 long, and weighs 7¾ oz. Ten of the shells from Meech's Lake weigh only 3 oz.

At the same locality is found a still more remarkable variety and one of no little beauty. In some respects it resembles *U. Raleighensis*, Lea, from North Carolina, and in others *U. turtuosus*, Sowerby, from Maryland. It is like the former in shape and in the numerous prominent rays which diversify its surface; and like the latter in the strange peculiarity that its valves meet at the ventral margin not in a straight but in a sinuous line. A correspondent writes that under Dr. Lea's treatment it would be entitled to rank as a species. Whether a variety of *U. complanatus* or a distinct species, it is a most unique and interesting shell.

Unio gibbosus, Barnes, appears to be rare, having occurred to me only in the Ottawa near Gilmour's Mills and at Templeton, always in deep water. It is a brown, elongated shell, attenuated posteriorly, and with the dorsal margin regularly curved. It bears a slight resemblance to some forms of *U. complanatus*; but may always be distinguished by its heavier shell, the deeper purple of its nacre, and especially by the great thickness of the lamellar tooth in the right valve.

Unio ellipsis, Lea, is not uncommon on sand bars below Kettle Island, but does not seem to occur in the Rideau or in the Ottawa above this City. It differs from all other species here observed in having the beaks very near the anterior end of the shell, where the muscular impression is of great depth and the shell itself of great thickness. The cardinal teeth are paralled to the lateral teeth and not at a right or oblique angle to them as in our other species. The nacre of many specimens is beautifully iridescent, displaying the colours of the prism and rainbow, chastened, softened, and made perpetual.

Unio rectus, Lamarck, which is easily recognized by its dark colour and elongated form, is found in considerable numbers in the Rideau near Billings' Bridge, but is comparatively rare in the Ottawa. The ground colour of the epidermis, which at first sight appears black, proves on closer examination to be yellow, profusely rayed with broad lines of very dark green. Young shells occasionally have a purple nacre, but in mature specimens only a trace of this is seen along the lateral teeth and in the cavity of the beaks. In the Rideau it is not unusual to find *U. rectus* almost six inches in length, and I have observed it quite as large in the Ottawa near Arnprior. Though smaller in the Ottawa here, it compensates for its inferior size by its finer form. The mantle of the animal is fringed with long and delicate vibratile cilia more beautiful than the richest lace.

Unio radiatus, Lamarck, is common almost everywhere in the Ottawa above the Chaudière. At the foot of the rapids near Mechanicsville are a number of islets along whose shores may be seen large heaps of shells, of which this species constitutes no inconsiderable part. The muskrat lives chiefly on the *Unionidæ*;

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and these heaps are the remains of his nightly repasts. To the collector they should generally serve only to point out that living specimens occur in their immediate vicinity; still, by presenting to him larger suites from which to choose than he could possibly obtain by dredging, they may sometimes afford good and even rare shells. I have obtained from them some of my best specimens of *U. radiatus*. It seldom attains a greater length than three inches, and is a very flat, obovate shell, of a green, olive or reddish color, with numerous narrow rays.

Unio luteolus, Lamarck, abounds in the Rideau Canal from the Sappers' Bridge upward, and is not uncommon in the Rideau River. Its color is from a yellowish green to a dark olive, with distinct dark green rays. In shape it varies much more than in color. Some shells are so inflated as to be almost cylindrical; others so depressed that they cannot, when the beaks are eroded, be distinguished by any external character from *U. radiatus*. Having probably studied only the exterior of the two species, a western correspondent writes that they merge into one another in Toronto Bay. Now they cannot possibly be more alike in Lake Ontario than they are sometimes here; and however great their outward resemblance, I find that they always differ internally, especially in the form of the cardinal teeth. In *U. radiatus* these are short, erect, and triangular. In *U. luteolus*, they are long, curved, compressed and oblique.

Unio cariosus, Say, occurred to me near Black Bay, Eardley, Quebec, where I was searching for nodules and fossils in the Champlain Clays, which there form the north shore of the Lac des Chênes. It is a thin, small, ovate, inflated shell, of a yellowish color, with a few indistinct rays. Some specimens of an accompanying species of *Leda*, which lived when the clays were deposited in the post glacial period, would be taken for recent shells, so well have they preserved their thin, delicate epidermis and fragile teeth through the many thousand years that have elapsed since then.

Unio occidens, Lea, is quite abundant in the Ottawa, near the mouth of the Gatineau, and along the sandy shores of Kettle Island. Its shape is remarkably uniform, varying only with the sex. It is an ovate and very much inflated shell, with large prominent umbones and closely approximate recurved beaks. The females are more broadly inflated than the males and are of an almost triangular shape, on account of which peculiarities they are liable to be considered forms of *U. ventricosus, Barnes*.

For beauty and diversity of coloring, there is not probably found in the world a fresh water shell which surpasses the *Unio occidens* of the Ottawa River. When young it is of soft and varied shades of yellow, green and red, the primary spectral colors, and sometimes of all three together, producing an effect of chromatic harmony that a painter might study with advantage. Mature specimens are rich as an autumn landscape in tints of yellow-brown and olive-green. All—but especially the young shells—have a porcelain-like lustre, which is seen at its best, when on a sunny day they lie on the clean, white sand, with just enough water to cover them. Then they shine and glow like opals in the fluent light. Moreover, their changeful colours are so differently combined with rays, sometimes few and sometimes many, fine as a hair or broad almost as an iris leaf, that, among hundreds of specimens collected, no two were alike in every respect. Each is, accordingly, a *unio*, in the sense that Pliny tells us the word was coined to express—a unique production—"from the circumstance,' he says, "that no two *uniones*—pearls—are ever found alike." The barbarians who found the pearls called them *margaritæ*.

That *U. occidens*, under exactly the same conditions of life, should secrete in almost infinite variety so many different pigments is a fact which challenges attention.

Unio subovatus, Lea, which is found in the Rideau Canal and River and in the Des Chênes Lake, is chiefly remarkable for the large size to which it some-

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times attains, a specimen from the canal beyond Hartwell's Locks measuring 5·5 in. in length, 3·4 in height, and 2·2 in diameter. It bears some resemblance in outline to *U. occidens* of which Say considered it only a variety. His opinion on this point is now held by very few; and I hardly think that anyone who compares the two as they here occur would care to pronounce them specifically identical. *U. subovatus*, is less inflated than *U. occidens*, and less approximate at the beaks, while with respect to beauty there is no comparison between them.

On the valves of this and other large species in the Rideau River I have observed—besides the curious spiral follicle of the larva of a phryganaceous insect, *Helicopsyche arenifera*, which was first described as a mollusk of the genus *Valvata*—a small isopod crustacean, which is worthy of note as being probably the best living, though degenerate, representative of the trilobites that once abounded here on the low tidal flats of the Silurian seas. It is I think the species described by De Kay as *Fluvicola Herrickii*.

Unio alatus, *Say.*, was found here by Mr. Heron in 1880, and was recorded from this vicinity twenty years ago, by Mr. Whiteaves in a valuable paper published in the Canadian Naturalist. There are a few specimens in the museum of the Ottawa Literary and Scientific Society, which were probably collected by the late E. Billings, the palaeontologist. As I have not met with it on my many excursions, I think it must be rare, or at least restricted to a small area. It is the only species found here in which the wing rises higher than the right line of the hinge margin. It occurs from Georgia to Vermont and westward to Nebraska and Manitoba. Certain other species as *U. spinosus*, *Lea.*, and *U. Shepardianus*, *Lea*, are confined within narrow limits to one stream.

Unio gracilis, *Barnes*, is another winged species which has not, till now, I believe, been recorded from any locality in Canada east of the Welland Canal. It is not at all common, Mr. Poirier and myself having found only five or six specimens during the summer. These were collected on sand bars near Kettle Island. It is an exceedingly thin and fragile, depressed, sub-triangular shell, of a greenish yellow color. The hinge margin is straight and prolonged into a large wing, uniting the two valves. It may be distinguished from *U. alatus*, by its greater fragility, lighter color, both inside and out, and by its differently formed wing.

Unio pressus, *Lea*, was found by Mr. Tyrrell, of the Geological Survey, in the Rideau near the Rifle Range. Only one specimen was met with, and that he has with great kindness presented to me. It is but little more than two inches in length, very much flattened, and the hinge margin is straight with a slight alated projection. The beaks are finely undulated. Its form, its internal and external color, together with the shape of its cardinal teeth, seem to connect it with the *margaritanæ*.

Unio Canadensis, *Lea*, was originally described from the St. Lawrence near Montreal. Both Mr. Tryon and Mr. A. F. Gray have referred to this species some shells which I collected in Nepean Bay. Mr. Gray writes: "It seems to agree well with the characters of *U. Canadensis*, and with Dr. Lea's figure. From these data, and without a typical shell with which to compare it, I am justified, I think, in referring it to that species." Mr. Tryon says: "I regard a shell which you sent me from Nepean Bay as the true *U. Canadensis*." It appears to be rare, only a few specimens having been found. It is of an oval shape and dark olive colour, with indistinct rays.

Unio borealis, *A. F. Gray*, is a new species. It occurs in the Ottawa, from the mouth of Brigham's Creek to Templeton, and probably much farther down. Although common, it is very seldom met with in good condition.

I first submitted this shell to Mr. Tryon, but the only specimens I had to send were so badly eroded that they could not be determined. A second lot,

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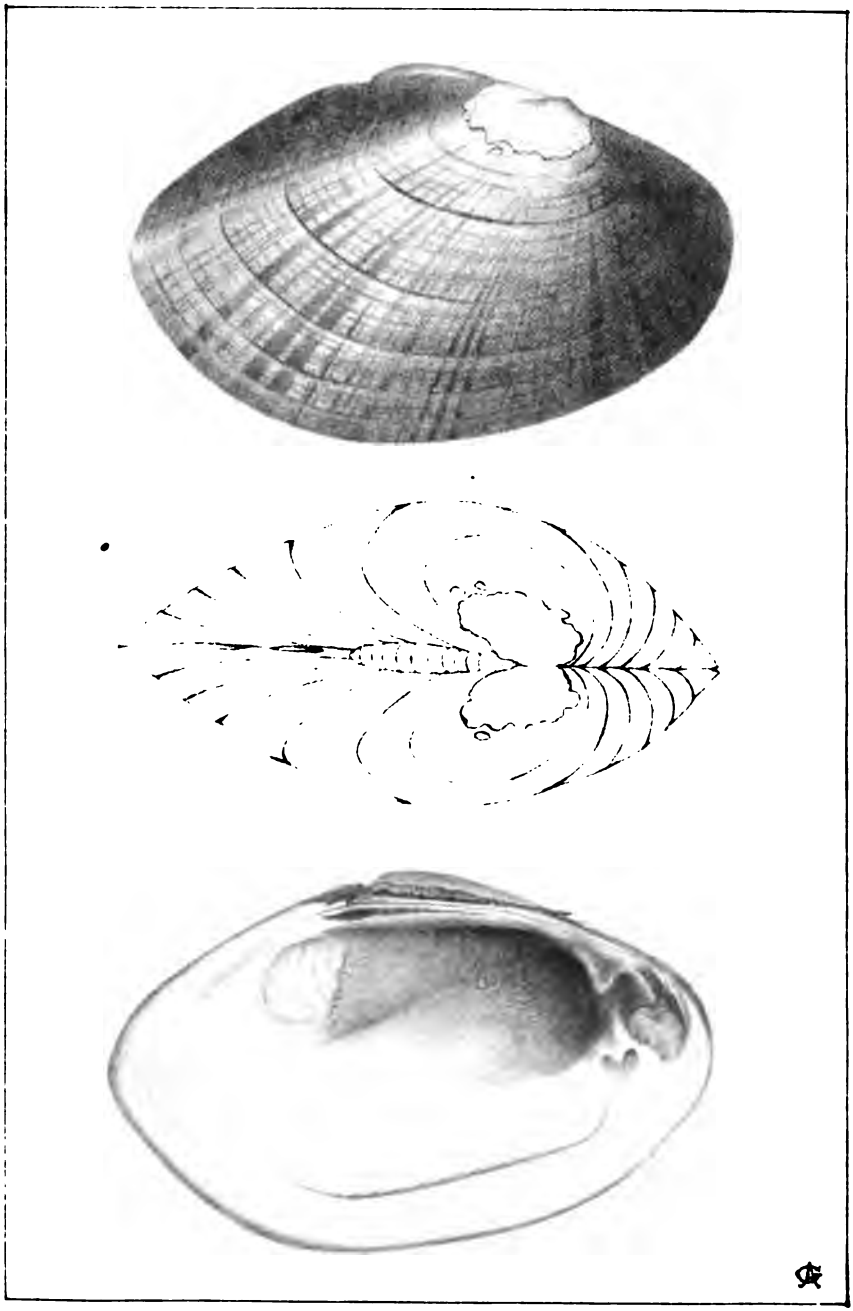

UNIO BOREALIS.—A. F. GRAY.

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little if any better, led him to think it doubtfully referable to *U. luteolus*,* from some forms of which the females are not easily distinguishable. Three out of four shells sent to a conchologist in Cincinnati were referred to *U. radiatus*, while the remaining one was considered a specimen of *U. luteolus*. The shells were really not in a condition to admit of being properly determined. Not until October of the past year did I succeed in collecting specimens which had the undulations of the beaks well preserved. I was led to go out so late in the season by a letter from Mr. A. F. Gray, relating to the shell in question, of which I had sent him specimens a short time previously. He regarded as correct my views that it differed essentially from both *U. luteolus* and *U. radiatus*, but thought that further study and comparisons might prove it to possess affinities with some other described species, and expressed a wish to see a large series of the best shells I could obtain. On my next holiday I went down the river to Duck Island and collected a number of male and female shells, including a few in fine condition. I despatched these to Mr. Gray on the day following, but heard nothing more about them, until February 28th, when I received the pleasing, though not unexpected information that the shell was undoubtedly a new species. The names *U. bellus* and *U. borealis* were suggested as appropriate. The latter seems the more fitting, and the species shall accordingly be known as *Unio borealis, A. F. Gray*. A description, promised at my request, has not yet been received, and I do not wish to describe the shell to-night, lest I should in any way interfere with the priority of my friend's description. The right of naming *U. borealis* belongs, to Mr. Gray, as he was the first to recognize its specific distinctness from any described *unio*.

[Mr. Gray's description was received some time after the reading of my paper and is here given in full:

UNIO BOREALIS,—A. F. GRAY.

Shell smooth, broken only by numerous ridges of growth; obovate, very much inflated in the female form, the male more compressed, very inequilateral, obtusely angulated behind and rounded before, the basal or ventral margin rounded, beaks badly eroded and but slightly raised; ligament thick, moderately long and dark brown; umbonal slope flattened, and but slightly carinated; epidermis variable, some specimens dark olivaceous brown with broad obscure rays of dark green, others yellowish green with numerous fine rays of a brighter green, cardinal teeth rather large, somewhat compressed and corrugate; lateral teeth thick, slightly curved, and with crenulate margins; anterior cicatrices distinct, that of the adductor muscle very deeply impressed; dorsal cicatrices posterior to the centre of the cavity of the beaks; posterior cicatrices confluent and but slightly impressed; cavity of the shell deep and rounded; cavity of the beaks obtusely rounded and deep; substance of shell very thick, thickest before; nacre usually white, occasionally rosy, and sometimes a beautiful pink, and beautifully iridescent.

Transverse diameter, 3·15 inches; altitude, 1·95 inches; lateral diameter, 1·65 inches. These measures are from a large female. A male shell measures: transverse diameter 3·15 inches; altitude, 1·90 inches; lateral diameter, 1·35 inches.

For this beautiful shell, and the privilege of describing it, I am indebted to Mr. F. R. Latchford, from whom I received quite a large series of this *Unio*, which belongs to the group of which *Unio luteolus* of Lamarck may be considered the type. It differs from that species in being shorter transversely, in having a much thicker shell and having the beaks badly eroded. In its outline it bears a

* After the above was writen, I sent some young specimens of *U. borealis, A. F. Gray*, to Mr. Tryon, and they have convinced him, he informs me, that the species is new.

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close resemblance to *Unio radiatus*, Lam., but is more inflated and has a heavier shell. It occurs in the Ottawa River at Duck Island; it has also been found in Leamy's Lake, near Hull, in the Province of Quebec.

The variety with pink nacre has a bright orange-brown epidermis with fine rays of dark green.

A young specimen is more elongated transversely, has perfect umbones which show four well developed folds, and has a rugose posterior slope similar to *Margaritana rugosa*, Barnes.

The soft parts have not been preserved; in consequence, their arrangement cannot be described.]

GENUS MARGARITANA, *Schumacher.*

The shell of this genus differs from that of *Unio* in having no lateral teeth. These, however, are not always entirely wanting in *M. margaritifera*, the celebrated pearl mussel of Great Britain and the North Atlantic and Pacific border regions of America. From the interior continental basin it is absent; and although common eastward in Quebec, it has not yet been found in this vicinity. How even a mollusk may affect the destinies of a nation may be inferred from the statement of Seutonius, that it was the hope of obtaining pearls from *M. margaritifera* which led to the invasion of Britain by Julius Cæsar.

Margaritana marginata, Say, occurs sparsely in the Rideau and Ottawa in rapid water, which, indeed, is the favourite habitat of our other species also. It is small, seldom of greater length than two and a half inches, moderately thin and transversely wedge shaped. In colour it ranges from a dusky green to a deep brown, with indistinct dark rays. The shells found here are much inferior in size and colouring to specimens of the same species received from the Mohawk River, New York.

Margaritana undulata, Say, is rare in the Rideau and is not common in the Ottawa, where the least unproductive locality that I know of is above the Little Chaudière along both shores of the river. In Meech's Creek it is quite plentiful, especially near the abandoned rubber factory. It is smaller than *M. marginata*, proportionately more inflated, brighter in colour, often so bright as to be really beautiful. The distant concentric and prominent waves on the umbones from which it derives its specific name, are seldom apparent except in young shells. Many old specimens are as thick and strong anteriorly as a *U. ellipsis* of the same size, while towards the posterior margin they are as thin and fragile as the most delicate *anodonta;* and thus, as well as by having cardinal and no lateral teeth, *M. undulata* unites in itself two of the most distinctive characters of the genera between which, in the plan of creation, *Margaritana* has been assigned its place.

Margaritana rugosa, Barnes, the largest we have of the genus, is abundant at many points along the Rideau, but is quite rare in the Ottawa. As found in the former stream it resembles the typical *U. complanatus* in shape but is of a greener colour, and may, morever, be easily distinguished from that shell both by the wrinkles which are situated along the post lateral margin up to the hinge ligament, and, of course, by the absence of lateral teeth. A shorter truncated form is occasionally met with in the same river.

I observed a few large and exceedingly fine specimens of this *margaritana* at the Chats Rapids, where I found them in a mixed company of *uniones* and *anodontæ*, thirty three in number by actual count, which were living together in apparent harmony in an open space between the rocks but little if any more than a square foot in extent. They were green in colour, and had the characteristic wrinkles prominently developed. One shell exhibited in a marked degree the strange deformity that its valves did not meet in a straight line, but, an inch or more from the posterior end, were bent sharply aside about forty degrees. I have noticed a few less striking instances of similar distortion in the same

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species from the Rideau. They are probably due to injuries received when young through coming into violent contact with a rock or pebble. To such a mishap the young of this species must often be exposed in the rapid water they frequent.

GENUS ANODONTA, *Bruguières.*

The transition from *Margaritana* to *Anodonta* is by no means abrupt: *nihil in natura per saltum.* It is made easy by a shell found here, which was first described by Say, and placed by him in the former genus—or rather in the genus corresponding to it that he had instituted, *alasmodonta*,—but which is at present universally referred to the latter. This species is now known as *Anodonta edentula*, Say. Although its name as it now stands expresses what may be called the reduplication of toothlessness, the shell is slightly exceptional to the best marked character of the genus—the absence of both cardinal and lateral teeth.

Anodonta edentula, Say, like its relatives the *margaritanæ*, is to be found in water flowing rapidly over a rocky bottom. The best localities along the Ottawa that I have met with are the Little Chaudière and Chats Rapids. A capital place for collecting it and seven or eight other species of the *Unionidæ* is the snye, as the lumbermen call it, between Mason's Mill and the opposite island. It is a comparatively thick shell, generally of a dark olive colour; but when the rays are few or narrow, the ground tint, a light brown, predominates. In the left valve of many specimens there is a short though well defined cardinal tooth with a small notch in it analogous to the deep cleft in the primary tooth of the left valve of *Unio* and *Margaritana.*

In the narrowest and most rapid parts of Meech's Creek, and not in the ponds into which it often expands, or the lake from which it flows, there occurs a fine form of this shell which appears to be identical with the variety of *A. edentula* described by DeKay, and called by him, after the river in New York in which it is found, *A. Unadilla.* It is more inflated than the *A. edentula* from the Ottawa, often very much larger and of a lighter colour.

Anodonta undulata, Say, is found in the Rideau near Billings' Bridge, and in the Ottawa at Kettle Island. It resembles the preceding species so much that many have thought the two identical. *A. undulata* is however a thinner shell more obscurely rayed and more angularly inflated. Additional and far more distinctive characters are revealed by the microscopic examination of the young of both species. Botanists, as Mr Fletcher told us two years ago, cannot always by the leaves and blossoms alone distinguish *Drosera longifolia* from *Drosera rotundifolia*, but their minute seeds present characteristics which place the specific distinctness of the parent plants beyond all doubt. So also with the embryonic young of these two species of *anodonta.* I have not examined them myself; but Dr. Lea's figures show that they differ in outline, and that while the hooks of *A. edentula* end in three points, those of *A. undulata* end in one.

Anodonta subcylindracea, Lea, which I have met with only at the Chats, is one of the most widely distributed shells of the genus, extending hence through the middle and western states as far south as Louisiana. Our shell in its ordinary form is identical with Dr. Lea's type. It is small, thin, inflated, almost elliptical in outline, and olive green in colour, with indistinct rays. Old shells are generally abnormal. They are so constricted along the basal margin opposite the hinge, and so much elongated that instead of being elliptical they are kidney shaped. This reniform appearance is observable in old shells of many species of the *Unionidæ*, *U. complanatus*, for instance, and notably *M. margaritifera.* An examination of the lines of growth will show that after a certain age the shell does not increase symmetrically. It grows rapidly in the direction of the umbonial slope, slowly in front, and scarcely at all opposite the hinge. The change produced in this way in the form of shells is very remarkable.

Anodonta Benedictii, Lea, occurs in several localities near the city, but nowhere in great numbers. I have found it at the Chats, and in a small lake on

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Meech's Creek. Mr. Fletcher collected a few fine specimens of the typical form in the Ottawa near the outlet of Leamy's Lake. It is a trapezoidal, slightly compressed, horn-coloured shell. The dorsal margin is nearly straight and is extended behind, where it forms a well marked wing.

Anodonta Lewisii, Lea, occurred to me in the Mississippi at Almonte, where it appears to be abundant. It has a much smaller wing than *A. Benedictii*, which it resembles, is more elongated, and somewhat less inflated. The beaks in perfect specimens have sharp prominent tubercles, which are arranged in a manner characteristic of the species.

Anodonta implicata, Say, is a species of which only a single living specimen has been obtained. It was found in a deep pool near the upper end of the old Chats Canal, after a search of an hour's duration, which I was led to engage in by seeing on the shore a few broken valves of an *anodonta* not previously met with. It is a large, thick, olive-brown, elongated, cylindrical shell, with a salmon-coloured nacre.

Anodonta Footiana, Lea, is not uncommon at the Chats. It is a thin, inflated, oblong, brownish species, obscurely radiated, and tinged with yellow posteriorly. A darker and less elongated form from Meech's Creek is said to be "identical with shells determined by Dr. Lea as his *A. Footiana*," which are now in Mr. Gray's cabinet.

Anodonta lacustris, Lea, inhabits lakes in the County of Ottawa. It is brown when aged, but young shells are greenish yellow. The tubercles on the beaks are arranged in close, concentric waves. Every specimen found in September, 1881, in a small lake in Masham, was infested by hundreds of mites, probably of the species found in *U. luteolus* and *A. fluviatilis* in the Rideau Canal. The same lake, which is about thirty miles from Ottawa, contains a plant, *Eriocaulon septangulare*, not recorded in the "Flora Ottawaensis" of Mr. Fletcher.

Anodonta fragilis, Lamarck, is common in Meech's Lake, near the outlet. It is an elongated, thin, depressed shell of a yellowish colour, with a straight dorsal margin, and pearly iridescent nacre. That the form regarded as *lacustris* is distinct from this appears to me somewhat doubtful.

Anodonta fluviatilis, Dillwyn, occurs in great numbers in McKay's Lake, New Edinburgh, and in the Rideau Canal; but is rare in the Ottawa, where it is found only in bays in which there is little or no current. In colour it ranges from a bright grass green to an olive-brown, with concentric yellow bands, and innumerable narrow, obscure rays. Sometimes it attains a length of six inches, but is generally about a third smaller. Its large size and brilliant colouring conspire to make it the finest *Anodonta* we have.

Repeated microscopic examinations of the young of this shell lead me to believe that the only observations which I find published on the young of the *Unionidæ* are not altogether correct. In his "Descriptions of the embryonic forms of thirty-eight species of the *Unionidæ*," Dr. Lea, says: "The base in all the species always presented the anterior and the posterior margins equal, which is not the case with any of the species when fully grown. That is, if a perpendicular line be raised from the middle of the basal margin to the middle of the dorsal line, *the right and the left divisions will be exactly symmetrical.*" Now, I thought that precisely the contrary was evident when the young of *A. fluviatilis* were observed under a high power; and Mr. Tyrrell and Mr. Fletcher, whose attention was called to the matter, thought so too. Dr. Lea, however, to whom I sent some of the young, wrote that on carefully examining them, he failed to notice the asymmetrical difference which I described. The venerable patron of the *Unionidæ*, now in his ninety-first year, kindly presented me at the same time with the work previously referred to on "Embryonic Forms," and with several other of his valuable publications. Here was observation opposed to observation. To ascertain whether I was right or wrong, I made use of the fine solar microscope of the College of Ottawa, which gives a magnification of two thousand diameters.

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As the outline of shell after shell was cast upon the screen, each was observed to be decidedly asymmetrical and unequally curved on the sides. The young of *U. luteolus* and *U. borealis* proved also to be inequilateral; and I have little doubt that the same want of symmetry obtains in the young of almost all other species. It seems, therefore, that Dr. Lea was mistaken in describing and figuring as symmetrical the embryonic forms of many species of the *Unionidæ*.

With *A. fluviatilis* closes the record of the species so far observed here. Extended as it is, for a place so distant from the metropolis of the *Unionidæ* in the Ohio Valley, it does not in my opinion include all the forms that occur in this vicinity. *A. plana, Lea,* and *A. Ferussaciana, Lea,* probably occur here; and when the numerous lakes and streams around our city are more diligently searched, they will, I feel confident, furnish very material additions to the present list of the Ottawa *Unionidæ*.

REPORT OF THE CONCHOLOGICAL BRANCH.

For the Season of 1882.

To the Council of the Ottawa Field-Naturalists' Club:

The undersigned beg leave to report that in this branch of the Club, nine members have been engaged in active work during the season, and that the researches made, (particularly by Mr. Latchford,) have been of a most thorough nature and have resulted in additions to the list of shells already recorded in this locality, and the discovery of some which may prove new to Canada itself; of these, a list is appended in which all are mentioned of which the identity has been proved without doubt. Descriptive notes of twenty-seven species embraced by the family *Unionidæ* will be given by Mr. Latchford, in a paper which he is preparing on that subject to be read before the Club.

H. B. SMALL,
P. B. SYMES,
Leaders of the Conchological Branch.

APPENDIX.

Descriptive notes of shells found in the vicinity of Ottawa during the summer of 1881, not before recorded on the Club list:—

1. *Amnicola limosa, Say.* This shell is abundant in ponds near St. Louis Dam. In Mr. Heron's collections (presented by him to the Ottawa Literary and Scientific Society,) it is marked "*A. porata*, Say." The true *A. porata* of Say is, however, quite a different shell; but the *A. porata* of Gould is a synoym of *A. limosa*, Say. The true *A. porata* Say is to be found in several lakes in Ottawa County. It is larger and more globose than *A. limosa*, Say, to which it is allied, and has a more distinct umbilicus. Its distribution too is more limited, being confined to the Northern States and Canada.

2. *Amnicola decisa, Haldeman.* Specimens of this shell have been found in Leamy's Lake. It has the labium more appressed than in any of the other species of the genus found in this locality; the form too is more elongated. It was found by Mr. Heron subsequent to the publication of his list.

3. *Pomatiopsis Cincinnatiensis, Lea.* (*Amnicola Sayana, Anthony.*) A few specimens of this species have been found in Dow's Swamp. This is the first record of it having been found in Canada. This shell must not be confounded with *Amnicola Cincinnatensis, Anthony.*

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4. *Limnæa megasoma, Say.* This beautiful and distinct species was first found in Meech's Lake by Mr. Latchford, in September, 1880, and a good series was secured during the past season. This species is the largest of the *Limnæidæ.* In beauty it is surpassed only by such exceptionally fine forms of *L. stagnalis* as occur here in the Rideau Canal. *L. megasoma* is easily distinguished from all other American species by its ovate form, thick shell, and rich chestnut-brown interior. Haldeman has made it the type of his sub-genus *Bulimnæa.* It is a northern species ranging from Vermont to Lake Superior, near which it was first found by Dr. Bigsby. It was once abundant in a pond on Nun's Island, in the St. Lawrence, opposite to Montreal, but of late years it appears to have become almost extinct in that locality.

5. *Limnæa lanceata, Gould.* Three specimens of this species were found by Mr. Fletcher, in Dow's Swamp in September last; previous to this no one but Agassiz appears to have observed it either in Canada or elsewhere. As late as 1865, the date of Binney's monograph on the American *Limnæidæ*, there was only a single specimen in the cabinet of the Smithsonian Institute at Washington. The locality of the shells found by Agassiz, and named by his friend Dr. Gould, was "Pic Lake" to the north of Lake Superior. The shell of *L. lanceata* is very fragile and slender. It not a little resembles *L.* (*Acella*) *gracilis*, Say.

6. *Limnæa caperata, Say*, var. *umbilicata, Adams.* By some authors this shell is regarded as merely a variety of *L. caperata, Say;* Adams, however, with others, claims that it is a distinct species and calls it *L. umbilicata.* According to Binney, who, following Haldeman, favours the former view, "It is found along the northern tier of States to Michigan; has been quoted from Louisiana; catalogued by Adams from Jamaica, and placed by Poey in the synonymy of *L. cubensis, Pfr.*" It would appear, therefore, to be a very constant variety, if, indeed, it be not a distinct species. Adams acknowledges that it resembles *L. caperata, Say*, but observes that in Say's species "the aperture is but one-half the length (in "*umbilicata* it is three-fifths) the revolving lines are raised, more distinct and "numerous, the *umbilicus* is rather less, and there is one more whorl." In this locality Say's species is abundant, but Adams' is very rare—only three specimens having been obtained so far. They were found in the Rideau River at the Rifle Range by Mr. Latchford. They were sent to Mr. Tryon for examination and returned marked "*L. caperata, Say*, var. *umbilicata.*"

7. *Limnæa emarginata, Say.* There once existed considerable doubt with respect to this variable shell and its identity with *L. catascopium.* Specimens in Mr. Heron's collection bear the latter name. It is now, however, very generally regarded as a distinct species. *L. emarginata* is a thicker, larger, and considerably wider shell than *L. catascopium.* It is a common shell near rapid water in the Ottawa and Rideau Rivers; very fine specimens are to be found about a mile above Billings Bridge. The true *L. catascopium* is less frequently found, being noted only from Brigham's Creek, Nepean Bay, and at the Chats Rapids, near Arnprior.

8. *Limnæa lepida, Gould.* One of the most interesting additions to the list is the above named shell which was found in Meech's Lake by Mr. Latchford in September. The naming of Mr. Latchford's specimen has been checked by Mr. Tryon and found correct. The specimen found differs from Binney's figure only in the slighter convexity of its whorls. Its size is exactly that of the shells described by Dr. Gould, $\frac{3}{5}$ inch by $\frac{1}{4}$ inch. *L. lepida* has heretofore been found only in Oregon. It is very rare.

9. *Physa gyrina, Say.* This widely distributed species differs from *P. heterostropha* in having a more elongated spire and a less deeply indented suture. It is found plentiful during the spring months, in ponds near the Canada Pacific Railway at Mechanicsville.

10. *Ancylus parallelus, Haldeman.* This fresh water limpet has been found in the Ottawa River and Rideau Canal, adhering to the submerged leaves of water

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plants and to other shells. Its favourite quarters are the inner sides of the valves of dead *Uniones* and *Anodontæ*, from which, if disturbed in the least, it is very difficult to detach them without breaking the shell. This species has been observed in New York and the Eastern States, but its range is more restricted than that of *Ancylus rivularis*.

11. *Zonites minusculus, Binney.* A few specimens of this minute Helix were found by Mr. Latchford in Eardley, Que., in September, and it has been reported as found near Toronto by Mr. Brodie. It has probably escaped notice in other localities on account of its small size.

12. *Vertigo milium, Gould.* A single specimen of this species was found by Mr. Latchford in Billing's Bush. It is remarkable as being the smallest species of the genus.

13. *Unio luteolus, Lamarck.*
14. " *cariosus, Say.*
15. " *occidens, Lea.*
16. " *gracilis, Barnes.*
17. " *pressus, Lea.*
18. " *Canadensis, Lea.*
19. " *borealis, A. F. Gray.*
20. *Anodonta edentula, Say.*
21. " *subcylindracea, Lea.*
22. " *Benedictii, Lea.*
23. " *Lewisii, Lea.*
24. " *implicata, Say.*
25. " *Footiana, Lea.*
26. " *lacustris, Lea.*
27. " *fragilis, Lamarck.*

} See Mr. Latchford's paper.

28. *Sphærium truncatum, Linsley.* This species resembles *S. securis, Prime*, and might at first sight be confounded with that shell. It differs, however, in being much less inflated, less inequilateral, and lighter in colour. Its post margin is more nearly a straight line, giving the shell the appearance of having been cut short—*truncatum.* This species is found in the St. Louis Dam pond. Unlike *S. rhomboideum* and *S. sulcatum*, it is very active. Specimens kept in confinement are almost always in motion. With the syphonal tube protruding behind they will extend the foot in front more than half an inch, attach it to the side of the vessel, and then contracting it will pull the shell forward. By this means they move in every direction with ease.

Pine Life.—H. Beaumont Small, M.D.

There are few of our members who have not noticed the remaining venerable specimens of *Pinus strobus, L.*, in the woods bordering the Bank Street road, just outside the city limits. The finest of these, and the one with which all were most familiar, stood at the edge of the road, guarding the bridge over Patterson's Creek; and I am sure all must have experienced a feeling of regret when the decree for its destruction went forth. Towering majestically above the surrounding growth, it was the landmark eagerly sought by the tired naturalist returning from a day's outing, and its prominence made it a fitted rendezvous for many sub-excursions of this Club. The greatest height of its double trunk was two hundred and thirty feet, and its circumference at four feet above the surface measured sixteen feet. This, judging from the size of other stumps in the neighbourhood—from the remains of prostrate trees—and from logs floated down

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the Ottawa from distant forests, is much above the average size of our large trees, now so rapidly disappearing before the forest fire and lumberman's axe. The rings visible on a transverse section numbered two hundred and seventy-one. In exogenous growth, you are aware the increase of tissue does not occur throughout the stem, but, the sap ascending from the soil, is elaborated in the leaves and, descending in the inner bark, forms a layer of new tissue on the circumference of the stem, around the growth of former years. At the close of the season, when life becomes dormant, the surface of the new wood hardens and when the next season's growth occurs, the denser layer becomes conspicuous as a well defined circle. In this climate, where growth continues steadily throughout the summer, ceasing only with the advent of cold, these rings indicate each year's progress, which knowledge applied to our tree, tells us that it has experienced the cold of two hundred and seventy-one winters, at least. This rule, so exact in our country, is not to be depended upon everywhere. In the tropics, where the variations of temperature are not so excessive, but more frequent, growth may cease and begin again twice or more often in a single year, a corresponding number of rings being formed. Some more advanced observers attempt to determine the weather of past seasons by the same means: a moist warm summer producing a large increase, a cold one preventing the formation of new tissue. To them the section of a tree presents not only a record of age, but also a weather chart of past years.

Many, I have no doubt, look upon such trees much as they look upon a huge boulder or other such surface conformation; it was there when they came, and there it will remain, unless destroyed by some physical force. In this simple way is the question of longevity settled, a question which has attracted much attention during the past few years. Unfortunately, the time required to verify facts, and the difficulty in obtaining trustworthy information, has prevented any important results being yet obtained. However, enough has been proven to show that each species of the vegetable kingdom has its special period of life, and the time allotted to some greatly exceeds that of others. Among the annuals and biennials this law is very evident, but among perennials, especially the long lived trees, it is obviously much more obscure. We know that the ash and yew live longer than the willow and poplar, and the pine much longer than the apple or plum, but no trustworthy table of the average life of each has yet been prepared. Numerous stories are told of ancient trees, but they are generally legendary and not to be depended upon. In England oaks and yews are standing, supposed to be eight hundred and twelve hundred years old; in Jerusalem the age of certain olive trees is placed at twelve hundred years, while the famous sacred Bo-tree in Ceylon has a record older than the Christian era. I find the age of pines variously given in works upon the subject, the greater number favouring one thousand years as about the average, but the record furnished by our tree would place it at a much lower figure, and I think we are justified in looking upon it as an example of the ordinary life of a white pine. Every member of the animal kingdom has its allotted age, but it is difficult to compare animal and vegetable life. In the former there is a continual formation and destruction of tissue; at first a period when the formation process predominates, then a period when the forces are equalized, to be followed by decline, when the balance of power is reversed and the body gradualiy fails to sustain life. In the vegetable kingdom there is no destructive agency at work. The tissue once formed always remains; but a time comes, a time peculiar to each species, when the central and oldest cells become dense, hard, and gradually cease to perform their function. It is the early setting in and rapidity of this process that determines the duration of the tree, which, as this hardening progresses become more brittle and liable to destruction. The years of a tree may be greatly affected by surroundings; for instance, one exposed to the influence of wind and weather would be much shorter lived than one sheltered by

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others growing in its neighbourhood, as also would one growing in a dry, sandy soil, as compared with another furnished with an abundant supply of moisture; but probably the variations are not greater, in comparison, than those occurring in the animal kingdom. In addition to their claim upon you as scientists, these few pines are well worthy of your interest. They are some of the oldest living things about us, they have witnessed one savage race overpower another, and the white man supplant them both; they are the remnants of a forest that began life at a time when Pioneers first reached this region, and were at least five years old when Champlain made his first voyage up the Ottawa.

The Utica Slate.—By Henry M. Ami.

Mr. Ami being absent from the city, this paper was read by the Secretary. It has since been revised and somewhat condensed by the author.

The Utica Slate formation derives its name from the town of Utica, N. Y., on account of the occurrence of an exposure of rock in the vicinity of that place, which American geologists have adopted as typical of the series.

It is further called a "slate" formation on account of the eminent slaty cleavage which the rock possesses; this generally corresponds with and is parallel to the divisional planes of stratification, but somtimes occurs cutting these planes at various angles. Instances of the latter may be observed at Montreal, on the mountain side, or near Ottawa in a quarry on the Montreal Road; such cleavage is due to lateral and other pressure, acting at various angles on the beds.

The term "Utica Shale" has also been frequently applied to rocks of this formation and may be said with greater accuracy to designate the character of the rock than the term "Utica Slate" does.

Until quite recently the Utica Slate has received very little attention at the hands of geologists and palæontologists. In the Geology of Canada, (1863), however, we find that a considerable amount of valuable work has been done, including researches into the palæontology, stratigraphy and lithology of the formation.

NATURE OF THE ROCKS.

To ascertain the nature of the rocks constituting these beds we must refer to some typical representative of the formation. In addition to the series at Utica, in the United States, which has been taken as the type of this formation, we have also, here in Canada, a good exposure situated near the mouth of the River Ste. Anne, Montmorenci, P.Q.

In the Geology of Canada (1863), there is a tabulated description of this series. The beds consist of a brittle black or brown, more or less bituminous shale, of much the same nature throughout. At the base of the section are two bands of yellow weathering (probably magnesian) limestone, and at the summit a thin band or two of sandstone and grit are found.

ORIGIN AND MODE OF DEPOSITION.

At the close of the Trenton formation, whether from subsidence of the northern part of this continent, or from the Arctic Seas having broken through their southern barriers—the Laurentian Hills—there seems to have come from the north, cold and muddy waters which carried down finely divided clay and sand and deposited them over the whole central plateau and synclinal hollows in various parts of the continent. Layer after layer was thus deposited, which, under the action of subsequent heat, pressure and other physical agencies, as-

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sumed their present character. Such a change of circumstances from those existing during the deposition of the Trenton formation also led to a change in th fauna of these Utica Seas; the *Graptolites*, which in olden times had swarmed the seas, during the deposition of the Calciferous and Chazy, now finding a suitable *habitat* returned in such abundance that the presence of these fossils may be considered a chief characteristic of this formation. *Trilobites* also, of forms diverse from those of the Trenton now made their first appearance in these turbid waters. It is no doubt owing to the great prevalence of these two types of life in that period of the earth's history that the rock owes its bituminous character.

This change which occurred at the close of the Trenton, was at first quite gradual, for, as may be clearly seen, the upper strata of that formation are for the most part separated from each other by thin bands of shale and argillaceous schists, indicating the oscillatory movements which then begun, foretold the complete disruption in the northern seas.

CHEMICAL COMPOSITION.

Several careful analyses of the rocks of this formation have been made by Messrs. Chandler & Kimball for Prof. Whitney, who have published them in the Geology of Wisconsin, and mention of which is made in the Geology of Canada, 1863. Of these analyses, chiefly of specimens from various parts of Canada, one from the Gloucester beds, in this neighbourhood, is noticed as yielding an especially large percentage of magnesia. The dolomitic nature of these beds is further shown by the appearance of their weathered surfaces, which assume a brownish-yellow colour.

Very little can be said as to the existence of minerals in these rocks, for they are so few, and, with the exception of *bitumen*, there are none of any importance. The occurrence, however, of a considerable percentage of this mineral in the shale at Collingwood, induced a company some few years ago, to start operations and extract the oil; but before much was accomplished the discovery of the same mineral in much greater abundance in the Hamilton shales, of Devonian age, caused the operations at Collingwood to be suspended; these, however, may prove of considerable value at some future date.

At the village of Windsor there is also said to be a valuable deposit of bitumen belonging to the Utica Slate. Other minerals occur sparingly, as *iron pyrites* (*pyrite or marcasite*) which is generally found replacing entirely or lightly coating fossils, particularly *trilobites* and *orthoceratites*. *Selenite*, or the hydrated sulphate of lime, also occurs in fine scales disseminated over the divisional planes of the strata, or, partly coating organic remains.

GEOLOGICAL DISTRIBUTION.

The remarks made will be in special reference to Canada; but in tracing out the belt along its line of outcrop, it will, of course, be necessary to notice parts of the United States. Beginning then with the deposit in its most easterly extension, it is found occurring near the mouth of the Ste. Anne River, Montmorenci, P.Q., where a portion of the rock exposure there shows 318 feet in thickness of Utica Slate. Proceeding thence in a westerly direction it forms a belt, at times interrupted, along the northern shore of the St. Lawrence, with a general south-easterly dip, sometimes concealed beneath the waters of the river, at other times cropping out at the summit of various anticlinals and on the superior axes of disturbed areas, whilst large tracts of it lie hid beneath the soil or drift. Thus, the belt proceeds till it reaches the city of Montreal, where several exposures can be seen on the Mountain side, at St. Helen's Island, Point St. Charles, and other places in that locality, the rock being much altered and hardened on account of the numerous plutonic dykes that traverse it. Hence the belt bends to the south-east, and then again to the south till it reaches Lake Champlain, where the formation can be traced beneath the waters of the lake by means of the islands

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which are almost entirely made up of rocks belonging to this formation. Proceeding southward and turning in a westerly direction round the base of the great Adirondack region, we find the formation for a considerable way completely obliterated. In the vicinity of Adams, N.Y., it again crops out, but gradually becomes narrower until the rocks of the Hudson River age conceal it; after this, proceeding in a course almost due west, it dips beneath the waters of Lake Ontario, and reappears again on the Canadian shore—a wide belt reaching from Port Newcastle to Canton near Whitby—at which latter place some very fossiliferous strata occur. This extensive belt crosses the Province of Ontario through the counties of Durham, Ontario, York and Simcoe, reaches Collingwood and there disappears. Subsequently following a north-westerly course beneath the waters of Georgian Bay, and striking points and capes of the Great Manitoulin Island, as well as many of the North Channel Islands, this belt narrows in gradually, diminishes likewise in thickness, crosses St. Joseph's Island, and again reaches the mainland, where, after a few miles of outcrop, it is lost sight of beneath the more recent overlying rocks and is not traceable further west.

Besides this continuous belt of the Utica Slate, there also occur isolated "patches" or "outliers" in other parts of Canada and of the United States. Along the Hudson River Valley there are many fine exposures, some of which give a total thickness of four hundred feet, (Dana). It also occurs in Virginia, Alabama, Tennessee, Ohio and Wisconsin, besides its probable recognized existence in Nevada by Dr. C. A. White (Walcott). Returning to Canada, not an unimportant outlier is that which we find in the immediate vicinity of Ottawa city. Indeed, it may be said that the deposits of Gloucester and Ottawa will give the diligent searcher many new and interesting forms of life peculiar to this formation, and as yet unrecorded in Canada. The Gloucester beds, as they are called, are pretty extensively developed, stretching out for several miles south and east of this city.

At Cumberland, Clarence and North Plantagenet, more of these outliers occur and have been recorded. There are also beds of shale belonging to this formation in the neighbourhood of L'Orignal, Ont. Another outlier, very remote from these, but of much importance is found in the immediate vicinity of Lake St. John, P. Q. This locality has yielded some very fine fossils, chiefly graptolites and trilobites. On the Islands of Anticosti and Orleans there are rocks and boulders belonging to this formation that have been drifted thither but do not occur *in situ*, as belonging to those islands.

From these facts, it may be safely predicated that the Utica seas must have occupied pretty generally the whole central portion of the North American Continent, bounded on the north by the *Laurentian Hills*, and on the east and west by the *Appalachian* and *Rocky Mountain* Ranges respectively.

THE OTTAWA AND GLOUCESTER BEDS.

These beds have proved a rich hunting ground to the palæontologist. From them the late Mr. E. Billings obtained and described many new and interesting species, and doubtless the careful collector will be well repaid for his labours in the same field. To the east of the city along the Rideau River the Utica Slate formation is particularly well developed and very rich in fossils. It also occurs at Rochesterville but the rock is brittle and almost destitute of fossils. By the Rideau we have several exposures each of which gives us a different horizon, with its characteristic set of fossils. Their stratigraphical relations are more or less obscure, yet with a little attention they can be tolerably well ascertained.

The exposure taken as representing the lowest of the series is that which is found at low water along the Rideau River at the Rifle Range.

These beds are very fossiliferous and abound especially in specimens of *pygidia* and *glabellae* of *Asaphus Canadensis*, Chapman, also *Triarthrus Becki*, Green; and crinoid stems associated with numerous specimens of *Leptæna*

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sericea, Sowerby, *Lyrodesma pulchellum*, Hall, *Orthoceras lamellosum*, Hall, and species of *Orthis* and *Strophomena*, etc. It is immediately overlying this exposure that we find cropping out several bands of yellow-weathering magnesian limestone, probably similar to those found at the St. Anne River, Montmorenci. In these bands are several specimens of *Conularia Trentonensis*, Hall, *Orthoceratidae* and *Calymene callicephala*, Green, etc. The beds here dip at a small angle to the east, across the river, where, a little above and in the vicinity of the rapids, beds overlying these are seen which present new forms such as *Modiolopeis modiolaris*, Conrad, *M. anodontoides?* Hall, another *Modiolopsis*, probably a new species, associated with *Avicula insueta*, Conrad, and a few graptolitic fragments. Following the line of outcrop down the river we come to Cummings' Bridge where a very interesting deposit occurs. Here the remains of *Triarthrus spinosus*, (Billings), are abundant, some very fine and probably perfect specimens having been obtained. *T. Becki*, (Green), also occurs there, and with it very numerous specimens of *Orthoceras lamellosum* of Hall, which are often found completely pyritized. The trilobites also are often coated over with pyrites.

Graptolites occur in this deposit, but not in a very good state of preservation. With these, are also associated numerous minute linguloid shells of the genus *Leptobolus*, most of which are referable to *L. insignis* of Hall, (24th Annual Report, N.Y. State Cabinet).

The total thickness of the exposure is about ten feet, the beds presenting much fission and crumbling. The next deposit worthy of note, and but recently noticed, is that which lies beyond the track of the St. Lawrence and Ottawa Railway, to the north-east of the last mentioned deposit. The chief characteristic of this is the abundance of graptolites. Very little has been done here as yet, and it has yielded *Graptolithus pristis*, (Hisinger?) *G. flaccidus*, (Hall.) *G. annectans* (Walcott). *G. sagittarius*, (Hall). *G. quadrimucronatus*, (Hall).

The graptolites in this bed are in a very perfect state of preservation, their condition greatly facilitating the identification of the different species.

Exposures of more or less importance also occur in the village of New Edinburgh and on the Montreal Road. At New Edinburgh, during the excavations made for water-works purposes, some very interesting forms were obtained by His Excellency Lord Lorne, among which may be mentioned *Ceraurus pleurexanthemus*, (Green).

On the Montreal Road, about two miles from the Rideau River, and resting almost at the summit of an axis of disturbance in a Trenton anticlinal, we find another exposure some fifteen feet thick, consisting chiefly of *brown, brittle, and highly cleavable rock*, but very unpromising as to fossils.

Now, taking these exposures severally, in order, and observing their stratigraphical arrangement as constituting different horizons, marked respectively by different sets of fossils, and looking at them likewise in their lithological character, we obtain a series of beds, though scattered about, giving us a total thickness of probably not less than forty feet.

Notes on Some of the More Interesting Fossils from the Ottawa Beds.

1. *Conularia Trentonensis*, (Hall). Several specimens of this Pteropod have been found, as mentioned above, in the deposit at the Rifle Range. It was at first thought to be *C. Hudsonia* of Emmous, but after referring it to Principal Dawson, he writes thus:—"After careful examination I cannot make your *Conularia* distinct from *Trentonensis*. There are two species described from the Utica, *C. Hudsonia*, of Emmons, and another, but yours does not agree with either." This species has not been previously recorded as occurring in the Utica Slate either of Canada or of the United States.

2. *Triarthrus spinosus*, (Billings.) Very fine and perhaps perfect specimens of this species have been found in the Cummings' Bridge deposit. Some new

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features with respect to this fossil may be worthy of being placed on record. The specimens from which Mr. Billings described and figured this species were either young and imperfectly developed, or else imperfectly preserved. The individuals besides attaining to greater dimensions, possess spines which differ in some respects from those represented. For instance, the spine said to be attached to the eighth thoracic segment, in well developed individuals, attains a total length of some twenty milimetres; in other words, is almost equal in length to the whole body of the trilobite and has a furrow or groove running throughout its entire length. In a few specimens collected at the Cummings' Bridge deposit, a spine is attached distinctly to the ninth instead of to the eighth thoracic segment as is generally the case. In addition, that spine, which is attached to the *occipital* or *neck segment*, projecting backwards over the six anterior thoracic segments, and about one-third the length of the other spine, often exhibits a similar longitudinal groove, whilst these spines often appear quite rounded or cylindrically attenuated, when completely pyritized. These spines, as well as the remaining two attached to the posterior angles of the cephalic shield, likewise grooved, and also the whole surface of the trilobite, present, under a low power of the microscope, some interesting features. There are minute tubercles scattered over the whole surface of the body and spines; on the latter they are somewhat larger in dimension. These give an appearance of striation to the spines when looked at with a lens.

Of the furrows on the glabella, besides the usual two pairs, we have a single one running in a direction transverse to the others. On each side of this furrow two crescent shaped depressions occur, similarly situated on the anterior part of the glabella and parallel to the two pairs of furrows. The precise function of these, and their place in the anatomy of the creature, the writer has not as yet been able to ascertain. Another feature about this curious little trilobite is the tubercle or short spine, (akin to those on *Triarthrus Becki*, Green, when adult) situated about the central portion of the occipital segment, immediately in front of the spine attached to this segment. Further investigation will no doubt determine the precise number of spines this species possessed; for the present, we are satisfied with stating that it possessed at least more than four spines.

Orthoceras lamellosum, (Hall). Numerous specimens of this species occur in the Cummings' Bridge deposit. These were at first referred to the genus *Endoceras* of Hall, and the species *E. proteiforme;* but after, several perfect detached septa of this species were found showing the position of the siphuncle very clearly, as being but very slightly eccentric, its nature as being that of a true Orthoceratite was revealed, only one siphuncle being evident.

Appended is a list of the fossils which have been found about Ottawa by the writer, and others, the names of whom are given opposite the fossils in the case where the writer has not also found specimens. In conclusion, my acknowledgments are due to Principal Dawson of McGill College, and Mr. J. F. Whiteaves of the Geological Survey, for assistance in naming specimens and for other information contained in this paper; and my thanks are also due to Mr. C. D. Walcott, of the United States Geological Survey, for a copy of his valuable memoir on the Utica Slate of the United States.

LIST OF THE FOSSILS FOUND IN THE UTICA SLATE, IN THE NEIGHBOURHOOD OF OTTAWA.

GENERA AND SPECIES.	REFERENCES.
Ptilodictya acuta.	Hall, 1847, Pal. N.Y., I. p. 74.
" recta.	Hall. Pal. N.Y., I. pl. 26, fig. 1.
Diplograptus pristis.	Hisinger ?; G. pristis, Hall.
Climacograptus bicornis.	Hall, Pal. N.Y., I. pl. 73, fig. 2.
Diplograptus mucronatus.	Hall, Pal. N.Y., I. pl. 73, fig. 1.

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GENERA AND SPECIES.	REFERENCES.
Graptolithus quadrimucronatus.	Hall, Dec. II. Can. Org. Rem. pl. 13, figs. 1–10.
" flaccidus.	Dec. II. Can. Org. Rem. pl. 2, figs. 17–19.
" annectans.	Walcott, Fossils of the Ut. Sl. pl. 1, 2. 2 *a*.
Lingula Daphne.	Billings, Pal. Fossils, vol. 1, p. 47.
" quadrata.	Eichwald, (Hall, Pal. N.Y., I. p. 96.)
" obtusa.	Hall, Pal. N.Y., I. p. 98.
Schizocrania filosa.	Hall, (*Orbicula filosa*,) Hall, Pal. N.Y., I. pl. 30., fig. 9.
Leptobolus insignis.	Hall, XXIV, Ann. Rep. N. York State Cabinet.
" occidentalis.	Hall, XXIV, Ann. Rep. N. York State Cabinet.
Leptæna sericea.	Sowerby, Murch, Sil. System.
Strophomena deltoidea.	Conrad, (Hall,) Pal. N.Y., I. p. 106.
" alternata.	" " " " " 102.
Orthis testudinaria.	Dalman, Hall, Pal. N.Y., I. p. 117.
" subquadrata.	Hall, Pal. N.Y., I. pl. 32, figs. 1*a*–0.
Zygospira Headi.	Billings, Pal. Foss. p. 47.
Avicula insueta.	Conrad, (Emmons, Geol. Rep, p. 399.)
" Trentonensis.	Conrad, 1842, Jour. Acad. Nat. Sc., III. p. 240.
Modiolopsis modiolaris.	Conrad, Pal. N.Y., I. p. 294
Lyrodesma pulchellum.	Hall, Pal. N.Y., I. p. 302.
Orthodesma parallelum.	" Pal. N.Y., I. p. 299, (*Orthonota parallela.*)
Conularia Trentonensis.	" " " p. 222.
" Hudsonia.	Emmons, Amer. Geol. p. 208. (Found by F. R. Latchford.)
Bellerophon bilobatus.	Sowerby, Murch. Sil. System.
Trocholites ammonius.	Conrad, Geol. Rep. N.Y., p. 119.
Endoceras proteiforme.	Hall, Pal. N.Y., I. p. 209.
Orthoceras coralliferum.	" " " " 312.
" lamellosum.	" " " " 209–210.
Serpulites dissolutus.	Billings, Pal. Foss. I. p. 56.
Asaphus canadenis.	Chapman, Can. Journal, 1856, p. 236.
" platycephalus.	Stokes, (*Isotelus gigas*, Dekay.)
Calymene Callicephala.	Green, Monogr, p. 30.
Ceraurus pleurexanthemus.	Green, Monogr. p. 84.
Triarthrus Becki.	" " p. 87.
" spinosus.	Billings, Rep. Prog. Can. Geol. Surv. 1857, p. 304.
" glaber.	Billings, Can. Nat. Geol. IV. p. 382.

In addition to the above, it may be well to mention the following found in this locality, but so far not identified with certainty.

(*a.*) *Monticulipora.*—Several specimens referable to two species of this genus.

(*b.*) *Crinoidal stems.*—Probably those of the genus *Heterocrinus.*

(*d.*) *Modiolopsis.*—Showing both concentric lines of growth and numerous radiating lines proceeding from the anterior extremity of the shell, and extending to its margin, allied in some respects to *M. cancellatus* of Walcott, but specifically distinct from it. Only two specimens of this shell have been found. When more are obtained it may prove to be a new species.

(*e.*) *Pleurotomaria.*—Allied to *P. subconica*, (small sp.)

(*f.*) *Leperditia.*—Probably *L. cylindrica*, Hall.

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ANNUAL REPORT OF THE COUNCIL.

To the Members of the Ottawa Field-Naturalists' Club:

The Council entrusted by you a year ago with the management of the Club, in submitting a report on the work of the year just closed, can, with much satisfaction, congratulate you on the progress which the Club continues to make in the objects for which it was organized.

Seventeen meetings of the Council were held, at which there was an average attendance of six of its members. Even an average two-thirds attendance of the members would be very satisfactory, but in reality the Council for a great portion of the year consisted of seven instead of nine members. Mr. Curtis only attended two meetings, and removed during the summer to the North-West, while Mr. Latchford only attended four meetings, and resigned his membership in the Club in the early part of November. The Council, however, did not deem it necessary to call a general meeting of the Club to fill the vacancies thus created.

One of the first acts of the Council was to appoint printing, excursion and soirée committees, and leaders in the various branches to give aid and information to members, and to keep records of the season's work. From these leaders were received valuable reports which were read at the soirées.

As stated in the circular then issued by the Council, prizes were offered in each branch for the best collection of specimens, and special prizes were also offered by the President. Only one of these prizes has been awarded, viz.: by the Botanical Branch to Mr. T. J. MacLaughlin for his fine collection of plants, the prize being "Gray's Manual of Botany." In connection with the prizes of the previous year (awarded after report of Council) it must be stated that the one given to Mr. Ami

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was "Flowers, their origin, shapes, perfumes and colours," by J. E. Taylor, Ph. D., and that the *American Naturalist* for 1882, given to Mr. Latchford, was generously bound by the publishers on learning that it was intended as a prize.

Three excursions were held during the season :—To King's Mere on 8th June; Des Chênes Mills on 2nd September, and Brigham's Quarries on 21st October. The first one was the most numerously attended excursion ever held by the Club, while the others were to places not previously visited. Repeated endeavours were made to arrange for other excursions, but without success. The completion of the Canada Atlantic and the westward extension, now building, of the line from Aylmer, will give the incoming Council a wider choice of localities to visit.

There were five soirées, at which the papers to be published in the Transactions were read. A noticeable feature of these soirées was the increased discussion, insomuch that it is recommended to the incoming Council to distribute the reports and papers, so that more time may, in some instances, be allotted for their consideration.

The election by you, at the last annual meeting, of three officers—Secretary, Treasurer, and Librarian—to divide the labours formerly falling entirely upon one—the Secretary-Treasurer—has tended greatly to a more systematic and satisfactory performance of the respective and increasing duties.

The report of the Librarian shows that the Club continues steadily through its published Transactions, to be brought into friendly connection with scientific societies in this and other countries, and to extend its influence. The number of publications received as donations and exchanges—chiefly the latter—during the year was more than double the number of all those obtained in the three preceding years. It will be unnecessary to give a list of exchanges received, as it will be published in the Transactions. The increasing number of books and papers now received by the Club will render it necessary for the incoming Council to purchase a book-case for their reception.

The Council caused to be printed the Transactions (No. 3) of the Club for the year 1881-82, consisting of 66 closely printed pages, and

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two excellent plates. The Transactions contain, in addition to the papers and reports read before the Club, a list of the birds so far recorded from this locality. Under the present system, all paid-up members are in possession of these Transactions, whereas, formerly, only one-fourth of the members obtained Transactions.

The Treasurer's report shows that the financial condition of the Club is very satisfactory, and that the increased subscription fee has not caused that diminution in membership that was somewhat feared when the change was made. At the close of last year the number of paid-up members was 88, and 22 have since paid for that year, making a total of 110. There are at present 99 paid-up members, and nine who may reasonably be expected to pay, making in all 108, or a decrease of two from the preceding year. During the year 16 new members were elected, and 22 ceased to be members, through resignation, removal from the city, or non-payment of dues. It will be unwise for the incoming Council to depend on a membership of more than 100, as the list now stands, and the advisability will suggest itself to them of taking energetic steps to obtain new members.

The number of corresponding members remains the same, although a change has been made in the substitution of Mr. Henry Edwards, of New York, for Prof. J. Macoun, who has made his home in this city, and has become an ordinary resident member of the Club. Mr. Edwards is a well known Entomologist, and has made valuable donations to the Club of his publications.

The Treasurer's balance sheet shows that, notwithstanding increased expenditures during the year, all claims against the Club have been paid, and that a satisfactory balance remains to its credit.

Signed on behalf of the Council,

W. H. HARRINGTON,

Secretary.

OTTAWA, March 20th 1883.

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TREASURER'S BALANCE SHEET.

The Treasurer in Account with the Ottawa Field-Naturalists' Club, 1882-83.

Dr.		Cr.	
To Balance from 1881-82...	$ 37 07	By Stationery, Postage, etc..	$ 19 21
Membership Fees.....	111 25	Excursion Expenses....	32 02
Excursion Receipts.....	30 10	Soirée do	7 08
Soirée do	5 70	Cost of Transactions No.3	117 65
Sales of Transactions...	32 15	Balance on Hand.....	40 31
	$216 27		$216 27

Wm. P. ANDERSON,
Treasurer.

20th March, 1883.

PROGRAMME OF SOIRÉES, 1882-83.

1. Wednesday, 6th December.
   President's Inaugural Address.—Mr. J. Fletcher.
2. Friday, 19th January.
   On the Laurentian System.—Mr. F. D. Adams, *B.A.; Sc.*
   Report of the Geological and Mineralogical Branch.
3. Friday, 2nd February.
   Fishes of the Ottawa District.—Mr. H. B. Small.
   Report of the Conchological Branch.
4. Friday, 16th February.
   Notes on and description of some Fossils from the Trenton Limestone. Mr. W. R. Billings.
   Notes on *Triarthrus Spinosus,* Billings. Mr. H. M. Ami.
   Report of the Palæontological Branch.
   Report of the Ornithological and Oölogical Branch.
5. Friday, 19th March.
   The Ducks of This Locality. Mr. W. P. Lett.
   Report of the Botanical Branch.
   Report of the Entomological Branch.

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LIBRARIAN'S LIST OF DONATIONS AND EXCHANGES.

Massachusetts Horticultural Society :—"Transactions, 1882." Part II.

Cambridge Entomological Club :—"Annual Report, 1882." "Psyche" (Jan.-Aug.)

Geo. Dimmock :—"Special Bibliographies." Nos. 1, 2 and 3. "Methods of bleaching the wings of Lepidoptera." "Anatomy of the mouth-parts of some Diptera."

Wm. Couper :—"Canadian Sportsman and Naturalist." Vol. I.

Sandford Fleming :—"Letter on Standard Time for the United States, Canada and Mexico."

Epping Forest and County of Essex Naturalists' Field Club :—"Transactions." Part VI.

Montreal Natural History Society :—"Canadian Naturalist." Vol. X, Nos. 2, 3, 4, 5 and 6.

American Museum of Natural History :—"Report." "Bulletin." Nos. 2 and 3.

Henry Edwards :—"Papilio." Vols. I and II, complete; Vol. III, Nos. 1 and 2. "Pacific Coast Lepidoptera." Articles 2 to 30. "A Tribute to the Memory of Geo. Robt. Crotch." "Darlingtonia Californica." "Remarks of Robert E. C. Sturnes before the California Academy of Natural Sciences on the resignation and farewell of Vice-President H. Edwards." "Proceedings of the California Academy of Natural Sciences—Annual Meeting, 1876." "Notes on the genus Catocalla, with descriptions of new Varieties and Species." "Descriptions of new Species of Butterflies." "On the American form of Papilio Machaon." "List of Lepidoptera taken around Dayton, O." "New Moths, with partial Catalogue of Noctuæ, by A. R. Grote."

W. L. Kells :—"Rural Canadian." 5 Nos., containing articles on Canadian birds.

Alexander Ramsay :—"Scientific Roll." Ten numbers.

Boston Zoological Society :—"Quarterly Journal." Nos. 1, 2, 3, 4 and 5.

Canadian Institute :—"Proceedings." Vol. I, Part 1.

Montague Chamberlin :—"Bulletin No. 1 of the New Brunswick Natural History Society."

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J. A. Guignard :—" Naturaliste Canadien" (containing observations on fertilization of Cypripedium by insects).

W. H. Harrington :—" Notes on some Species of Uroceridæ."

Buffalo Naturalists' Field Club :—" Bulletin." No. 1.

W. L. Scott :—" Report of the Geological Survey of Canada, 1879-80."

P. B. Symes :—" Report of the Department of the Interior." 1881.

H. B. Small :—" Mineral Resources of the Dominion of Canada."

Carl H. Schultz :—" Mineral Water Controversy."

Physikalisch-ökonomischen Gessellschaft-Königsberg :—" Schriften-der Physikalisch-ökonomischen Gesellschaft." 13 Nos. 1876-1881.

Jos. M. Wade :—" Ornithologist and Oölogist." 1882.

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THE PRESIDENT'S INAUGURAL ADDRESS.

JAMES FLETCHER.

Members of the Ottawa Field-Naturalists' Club, Ladies and Gentlemen:

Another year has passed and it is again my lot to give you the opening address of the winter course. It is with much pleasure that I have to inform you that the affairs of the Club are in a very satisfactory condition. Our membership roll becomes steadily larger, and, I am happy to say, includes several ladies. The Club is becoming day by day more widely known and popular. Its transactions are sought in exchange by kindred societies in all parts of the world, and I have no hesitation in saying that it is having an appreciable effect here in Ottawa towards educating the community to take an interest in the many beautiful objects of nature which surround them on every side. I will not, perhaps, go the length some of our correspondents do, and say we are doing more than any other local Society in Canada in furthering the study of Natural Science; but yet it would be affectation not to acknowledge that, for the age of the Club, and for the size of the population of the city, from which it has to draw its members, the work that has been accomplished is most creditable. In glancing through the three parts of Transactions which have been published, one noticeable feature is that the work has been evenly distributed, that it has not all been done by one or two only of the most active members; as an instance, during the three winter courses of lectures, there have been 31 papers on original work, and these have been read to us by as many as 22 different members of the Club. Now, this, I consider, is an exceptionally large proportion, for of course there are one or two of our leading naturalists from whom we like to hear something every year, and also, at the same time, there are, as you all know, several of even our most active workers in the field who have never yet given us the benefit of their studies and researches in the shape of written papers which we could publish. In this year's programme you will observe that there is only one set paper for each evening; this has been thus

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arranged by the Council in order that there may be a short time at every meeting during which can be read notes of any interesting occurrence or discovery which, although of importance as a fact to be recorded, may not be of such a nature as to warrant the preparation of an elaborate paper. I venture to hope that before the season is over we shall have, in this way, many valuable observations brought under our notice. This leads me again to impress upon you all the necessity of taking notes. It is utterly impossible for any one who wishes to advance in the systematic study of Natural Science to carry the results of all his investigations in his brain. A Naturalist should have his note-book always with him—in the field, in his study, and even in carrying out his daily business. Everything not before observed must be noted down at the time, and no pains must be spared to have these notes systematic, exact, and, above all, legibly written; the date, locality and circumstances must always be given, and observed facts must never be mixed up with theories or conjectures. There is a great temptation for everyone to get into a hurried, untidy way of making notes, under the idea that as they are only for his own use and no one else will ever see them it does not matter. This is the greatest mistake imaginable, for experience teaches that if notes are to be of any real use for future reference the greatest care must be taken with every detail. It is seldom that notes are required immediately after being made, because, of course, the original occurrences are fresh in the memory; but it frequently happens that some unexpected event turns the mind to a branch of study which has been comparatively neglected for a long time; and I know of nothing so disappointing as, upon turning up your notes of experiments or observations, which you remember to have prosecuted most carefully, to find that, at the time, they had been scantily or imperfectly recorded. In scientific matters the memory must never be trusted to for anything; whenever a fact is proved, note it down; if true, it is sure to be of use either to yourself or someone else at a future date.

In addition to the short notes by members at the different soirées, greater efforts will be made this year to exhibit attractive specimens and collections, and if there is any one here to-night who possesses anything of more than usual scientific interest they will confer a favour on the Club by notifying the Secretary, and lending it for one of these

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evenings. During the past year important work has been done by the Club towards carrying out its main object, viz.: the investigation of the Natural History of the locality. New plants and fossils have been found, and new birds have been observed, and, notwithstanding that the season has been exceptionally barren, as far as perfect insects are concerned, the Entomologists have succeeded in securing some rare species both of Coleoptera and Lepidoptera, as well as some rare larvæ of the latter order. Notices of all these discoveries will be given in the reports of the leaders of the several branches.

The number of our corresponding members remains the same; but there has been a slight change in the substitution of the name of Mr. H. Edwards, the editor of "Papilio," for that of Prof. Macoun, who is now an Active Member of the Club. By the appointment of Prof. Macoun on the Geological and Natural History Survey, and his removal to Ottawa, the Club has received a most powerful acquisition. Prof. Macoun is well posted in all branches of Natural History, and a thorough Botanist and Ornithologist, one, too, who is as generous and able in imparting information as he is energetic and successful in acquiring it. To Mr. W. Saunders the Club owes some kind and complimentary notices in the "Canadian Entomologist," a spirited monthly magazine quite indispensable to everyone who wishes to study Canadian insects. Mr. Saunders, too, is just about to supply a want, which has for very many years been felt in Canada, by the publication of a work on the Insects injurious to Fruit Trees, and his name alone is sufficient guarantee that it will be thoroughly done. Our other corresponding member, Mr. Hill, still continues to show his interest in the Club by frequent remittances of British Columbia plants and insects. During the past season a box of beautiful Fresh-water Shells has been received from Mr. Gilbert Heron, who is now in Texas, and the Library has been enriched by the addition of several valuable works, chiefly transactions of other Societies and Magazines of Natural History. Among these I would call special attention to the following:—

Twelve parts of Transactions of the Physico-Economical Society, of Königsberg, received from the Society through the influence of Prof. R. Caspary. This Society is one of great influence, and the publications are of a very superior class. Of special value to the Entomologist are

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"Psyche" and "Papilio." The first named has been published for some years by the Cambridge Entomological Club, and ranks in age next to the "Canadian Entomologist." "It is indispensable to everyone occupied with the insects of North America." "Papilio," unlike "Psyche," is entirely devoted to a single order of insects—the Lepidoptera—and contains descriptions of many new butterflies and moths in addition to more general matter. A complete set of this magazine has been presented to the Club by Mr. Henry Edwards, the editor, and also one of our corresponding members, together with a valuable series of original writings on Entomology, published at different dates. The "Canadian Naturalist and Sportsman," published in Montreal, is ably edited by Mr. W. Couper, who is well known as an energetic hard-working student of nature, well worthy of support by all naturalists. Dr. A. E. Foote's "Naturalists' Leisure Hour" is a most valuable little paper, which gives every month, together with interesting items of science and extracts from the best scientific periodicals, a list of works for sale, in all branches of Natural History, and one can thus frequently secure a rare book for a small sum.

It is not often in the scientific annals of any country that so many important events occur as we have seen take place during the last summer here in Canada. First, and undoubtedly the most important, was the formation and formal opening of the Royal Society of Canada. This institution, which was conceived and brought to perfection mainly through the foresight and well-directed energy of our noble patron, His Excellency the Governor-General, is based on a general plan drawn from the leading national academies in other countries. In England the Royal Society occupies itself with scientific subjects only, and the same may be said of the National Academy of the United States. Our Canadian Society, imitating the Royal Irish Academy, cherishes in addition literature and history. The Institute of France, composed of five sections, includes also fine arts in its scheme. All of these bodies, founded at different dates, have the same object in view, namely, the cultivation and encouragement of all branches of intellectual culture, by the bringing together periodically, from all quarters, the scattered workers (who form always so small a proportion of the whole) for the mutual encouragement and interchange of ideas—than which nothing

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so soon clears away inaccuracies and narrowmindedness, and, in fact, without which progress is impossible. Nor are the proceedings of the Royal Society confined entirely to its members. To keep up its dignity it could only include the very first men in letters and science; but as in a large country like Canada it was very difficult to decide upon whom this honour could be conferred, the only true course which could be followed was adopted, namely, judging of men not by reputation, but by the works they had actually produced. It was, however, felt that there were many able men who, although they had never published any completed works, were yet capable of producing work which would not only bring credit on themselves, but on their country also. As a means to benefit by this, it was decided to invite each of the societies of any acknowledged standing in science and literature to send annually a representative delegate, to attend the meetings, who would have the privilege of reading papers by members of his own society, and joining in all the discussions that might arise on the different subjects introduced, and further, the papers so read would be treated exactly the same as those of the full members of the Royal Society, and if of sufficient value for publication would be included in their Transactions. I am sure it is a matter of no small gratification to all present to hear that your Council has been notified by the Secretary of the Royal Society that this Club is considered worthy of being represented at the next annual meeting. I may mention, too, that in acknowledging this compliment the Council stated that whoever was chosen by the Club as President for next year would also act as delegate on that occasion. The Royal Sociey is not content with reading and discussing papers alone; already they have taken an important step in petitioning the Government to abolish the duty on scientific publications, and have prepared a plan of action which, as soon as funds are available, will be put in force for communicating with different parts of the Dominion, with the view of building up a National Museum. As no political influence has been allowed to creep in, it is indeed to be hoped that the Government will see its way to make a grant for the purpose of assisting them in carrying out what they propose, and in publishing the results of their labours. Moreover, the obligation will not be all on one side, for, as Dr. Sterry Hunt has remarked, "the executive authority will always have in the Society

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an organized body of councillors, drawn from what is highest and best in the scientific life of the nation, to which they can always look for advice and direction in scientific matters relating to the interests of the State." It seems to be universally conceded that all the preliminary steps were most wisely thought out and arranged, and every care taken to choose the very best men Canada could produce to represent the different sections. The choice of the Secretary, the active officer, upon whom devolves all the hard work, and upon whose energy so frequently depends the success or failure of a new venture, was a very happy one in the person of Mr. Bourinot, also one of our members, and so well known to every reader and student of Canadian History, for his charming articles, which have appeared from time to time in the serial literature of this country, and whose writings have received most favourable notices in England, both from men of letters and the press. The event next in importance, to which it is neccessary for me to refer, is the late meeting of the American Association for the Advancement of Science, held in Montreal. Scientific life had its birth in Canada in 1857, when the American Association met here before, and from that time on, fostered by a few here, and nobly helped by our friends across the line, it has gone on quietly gaining supporters and devotees, until now scientific knowledge is recognized by all to be a necessity. The strides taken in this direction and the discoveries made by its aid are almost beyond conception. At the meeting in Montreal were gathered together the leading Scientists of this continent, and not a few Canadians embraced the opportunity of meeting personally and consulting with the great minds, which, by means of correspondence, had, perhaps, for several years been necessary to them in carrying out their studies. When the joint excursion, composed of the members of the American Association and the Forestry Congress, honoured our City with a visit I am happy to say that the members of this Club were among the most active in making and carrying out arrangements for their reception and entertainment; and how far overpaid were we for any trouble we may have taken, by the pleasure of meeting and conversing with such men as Principal Dawson, of McGill College, the President of the Association for the year; the celebrated Biophysiologist, Dr. Carpenter, acknowledged to be one of the first philosophers of the day; or Dr. Asa Gray,

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who has done more for Botany in America than any other living man, to whose every word our Botanists eagerly listened ; or to Dr. Brewer, author of part of the Botany of California. Dr. George Vasey, who had promised, if possible, to pay Ottawa a visit, was, much to our disappointment, detained in Washington by official business. Among many other men of note who visited us on this occasion may yet be mentioned, Dr. Rae, the Arctic explorer ; Prof. Dall, celebrated for his researches in Alaska, and Profs. Newberry and Hall, the Geologists. Those of us who were fortunate enough to attend the meeting in Montreal might have met many more celebrities, as Dr. Sereno Watson, the first authority on Botanical Nomenclature, and at the annual meeting of the Entomological Society of Ontario, held at the same time, might have listened to the experiences of, and consulted with, men like Dr. Hagen, and Profs. Riley, Comstock, Mann, and Fernald, among many others who rank among the first Entomologists of the day, and whose names are almost as familiar in Europe as they are here. With regard to the Forestry Congress, which was convened immediately previous to the A.A.A.S., it would be impossible to mention anything of greater importance to Canada than the subjects which were discussed at its meetings, viz : the protection and preservation of the forests, which have been the source of the greater part of her wealth. Judging from the crowded meetings, and the enthusiastic utterances of the delegates who attended from every direction, as well as from the vital importance of the subject, which should only require to be brought prominently before the public as it was at this time, we may confidently hope that before long the working of this Society will be manifest from one end of Canada to the other, and many of us here may yet live to see the vast prairies of the North-West Territory covered with a mantle of luxuriant foliage, as some people believe they formerly were.

During a trip through a large tract of this country in September last I paid special attention to this matter, and I see no reason whatever why many of our hardy trees should not flourish there if the seeds are sown and the young plants protected for a year or two by rows of the indigenous willows which grow by every stream. I have sent to a friend in Regina a supply of some of the seeds of this district, and

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hope in a few years to hear that they were only the first of many plantations, started by other settlers through that fertile country. One of the good effects of the attention paid to tree planting will doubtless be the beautifying of our streets and public highways, by the planting of shade-trees in every available spot, for one of the wise provisions of the Society is that every member must plant 25 trees every year or pay a subscription.

In 1884 Canada is to honoured with a visit from the British Association for the advancement of science and there is little doubt but that the study of the natural sciences will receive as great an impetus from this visit as it has from that of our American cousins.

But I have dwelt at sufficient length on these matters to show that we in Canada have received such benefits during the past year as to make us responsible for much in the future. It is therefore the duty of everyone, who takes a true interest in the welfare of his country, to strive to help on in every way possible the cause of science, so that no benefits may be lost which are derivable from these events I have mentioned, and which surely mark a new epoch in the intellectual development of our country.

In looking over the programme of this winter's entertainments, you may have noticed that it does not include any papers on Entomology or Botany. With your permission I will endeavour to remedy this deficiency by directing your attention for a few minutes to some matters in these two branches which it has occurred to me might be entertaining and instructive.

* * * * * *

A case of insects belonging to the order Hemiptera, which had been caught in the vicinity of Ottawa by Mr. Fletcher and Mr. Harrington, was exhibited, and the life, histories and habits of the most interesting were explained. This was much facilitated by some fine enlarged figures executed by Mr. Harrington on the black-board.

* * * * * *

Now there are a few points of botany I wish to bring before your notice. Some of you may remember that in my inaugural address last year, I drew your attention to the small flowered yellow water-lily which is found in the Ottawa River and which Botanists have

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always considered to be an American form of the European *Nuphar luteum.* I then stated that, from an examination of the fruit, which is very rare and hardly ever perfectly developed, as well as from differences in the stigmatic disk and habit of the plant, I believed it was only a hybrid between the two species *N. advena* and *N. Kalmiana* both of which grow in the same locality. I also stated that, at that time, this opinion had not been confirmed by any other Botanist. When in England last year I examined all the plants of this order in Kew herbarium and there found a few specimens apparently identical with ours labelled "*N luteum*, variety. From America." I also inquired who was the highest authority on *Nuphar* and was referred to Prof. R. Caspary, the Director of the Botanic Gardens at Konigsberg, in Prussia. I wrote to this gentleman on the point in question, sending him both dried specimens and living roots, and, at the same time, asked him his opinion as to the identity of *N. Kalmiana*, Pursh, with *N. pumilum*, Smith, supposed to be identical, but concerning which I could not satisfy myself. His answer, received on 20th March last, was very satisfactory. He writes, after detailing some most interesting experiments with European species, which would be too technical for reproduction here, but which I may state lasted over a period of 20 years: "I have not the slightest doubt but "that your *Nuphar luteum, var. Canadense* is *Nuphar advena* + *Kalmiana.* "It is intermediate between the two, and what is decisive is this, that its "pollen is bad. There was not much pollen in the flowers you sent, but "I got 155 grains, and of these only 7, as far as it is possible to judge "from the dry specimens, had any fovilla; that is, about 95 per cent, were "bad. *Nuphar advena* and *Kalmiana* both have very good pollen." Again, on the other question, he writes: "From many experiments "(some of which he details) I conclude with complete certainty that "*Nuphar Kalmiana* and *N. pumilum* are different species, although the "morphological differences are very slight, but the two plants abhor each "other physiologically."

Through the kindness of Mr. Robertson, the Superintendent of the Government gardens, I am enabled to exhibit to you this evening a most remarkable biological specimen, which illustrates better than anything I have ever before seen the beautiful truth first enunciated by the poet Goethe, that all the petals, stamens and pistils of a flower are but

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leaves, and the flower itself a small branch specially modified for the purpose of reproduction. In this *Fuchsia* flower there is one ovary and one tube, but instead of the four sepals presenting their usual appearance two of them are foliaceous leaves; this is, of course, abnormal; but the chief peculiarities are in the next verticil of leaves which forms the corolla, for two of these are changed into small, but perfectly formed, and pedicelled buds; and it is carried further than this, for even inside this there is another large bud which represents the pistil.

I fear I am trespassing on your patience, but there is yet one subject more upon which I should like to say a few words. It is with reference to the use of making collections, and I take much pleasure in specially recommending a little work by Dr. Taylor, the Editor of Science Gossip, "On the Collection and Preservation of Natural History Objects."

The great end of all scientific study should be the development of a love for the objects investigated, and a thorough mastery of all that can be learnt concerning them. This can only be done by collecting specimens and preserving them in the most convenient manner for reference and one fault which must be guarded against is the amassing of a large number of specimens just for the mere sake of having them. Nor is much gained even if a collector is well acquainted with the Latin and English names of Natural History objects; there are many people who can give the names at first sight of every specimen in a large collection, and yet who know nothing of the history of one of them. It would be, by far, better to know well the history of one specimen in a large collection than to know all by name. Let the learning of the names be the alphabet of science, a means by which a further knowledge can be acquired, and let every specimen represent so much information, to which the very mention of its name will conjure up a crowd of associations relative to the study by which you became acquainted with it. The use of a collection should be, in general terms, a means of providing material for study at any convenient moment.

In building up a collection always try to secure perfect and characteristic specimens, so that any student referring to your collection can learn as much as possible about each species. It will sometimes be necessary to get specimens from naturalists living at a distance, and this

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will bring you into correspondence with men of kindred tastes in all parts of the world. The pleasure of making a collection is entirely in the associations which centre around it, and the intercourse which is, by its means, brought about with other students. Large numbers of duplicates will always be accumulating; these should be carefully preserved for exchanging; but, remember, as duplicates they are worthless to you, and never attempt to drive a bargain, or to get value for value, but always strive to give more than you receive. It is better by far to give away every specimen for nothing than to hoard them up to be possibly destroyed by insects, or even to take up room which could be better employed. Never send away a poor specimen; of course, always preserve the best specimen obtainable for your own collection, and if of a species not represented, preserve even a very poor one until you get a better, but after this send the very best you have to the first correspondent who asks for it. If a specimen is too poor to send away destroy it and get it out of the way. Never promise a rare species unless you actually have it,or are positive you will be able to carry out your promise, and, above all things, endeavour to gain a reputation for fair-dealing and generosity.

NOTE.—The following specimens, mentioned above, were exhibited:—Specimens of *Nuphar advena* + *Kalmiana*, Caspary, and the two species *N. advena*, and *N. Kalmiana*, from which this hybrid is derived. A painting of the first by Mr. W. H. O. Watts. Two plants of the Fuchsia, one with the normal flower, the other with the remarkable abnormality referred to above. Microscopic slides of *Psylla celtidis-mamma*, Riley. A case of Hemiptera. A painting of *Lewisia rediviva* by Mrs. Chamberlin.

ON THE LAURENTIAN SYSTEM.

FRANK D. ADAMS, B.A.,-Sc.

The Laurentian System is the oldest series of stratified rocks which we are at present acquainted with on our earth. In whatever part of the world we can extend our observations below the base of the newer fossiliferous rocks, we find a great series of schists or slates, and below these again a great series of various kinds of highly crystalline rocks, gneisses, quartzites, etc., often with bands of limestone, and

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which, as far as we at present know, are, with the exception of eozoon, quite destitute of organic remains. This latter is the Laurentian System which we are to consider for a few minutes this evening. In many localities the overlying series of schists is wanting, so that the newer fossiliferous rocks repose directly on this older gneissic system. The Laurentian is then the foundation on which all the more recent systems are laid down. It is the only universal formation, since it exists in all parts of the world, although in most places concealed by newer deposits. This great system of crystalline rocks, although pretty uniform in lithological characters, is known by different names in the different countries where it has been studied. The name Laurentian, from the River St. Lawrence, along whose northern shore it extends for several hundred miles, was given to it by Sir William Logan, who spent much time in studying it during the earlier years of the Geological Survey of Canada. In Germany and Scandinavia it forms the lower portion of the "Grundgebirge." It has also been called "Urgebirge," the Primitive Formation, and forms part of the Archean System of Dana.

In addition to the large areas over which the Laurentian is exposed in North America, it is extensively developed in various other parts of the world. In Europe it is most widely spread in Scandinavia and Finland, but occurs in Bavaria, Bohemia, and probably Silesia, in Germany, as well as in the north of Scotland, and probably in many other localities. Baron von Richthofen has recently described the occurence of two unconformable series of gneisses in China, both of which he correlates with the Laurentian System. He states, however, that they are destitute of crystalline limestone. In India immense areas of gneissic rocks have been mapped by the Geological Survey of that country. Similar rocks are also found in Japan and in south-east Africa, and occur over very extensive areas in Brazil, Venezuela, Chili, and the Guianas.

The area occupied by Laurentian rocks in Canada was estimated by Sir William Logan to be about 200,000 square miles. Speaking generally we may say that they form a band extending from Labrador to the Ottawa, and which, after sending a spur across the boundary line into the United States, forming the Adirondacks, takes

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a sharp turn, sweepi off in a north-westerly direction to the Arctic Ocean. The two arms of this band thus form tangents to the Arctic Circle. The northern limits of those Laurentian rocks is not as yet exactly known. The Gulf St. Lawrence forms its southern limit from Belle Isle to Cape Tourmente, a distance of about six hundred miles. For the next two hundred miles their southern limit runs west south-west, and is distant from the St. Lawrence in rear of Montreal, about thirty miles. It then follows the Ottawa for a hundred miles, turns south toward the St. Lawrence, meeting it again at the Thousand Islands, which are caused by the passage of this belt of hard rocks across the river. Crossing at the Thousand Islands, the Laurentian expands into an area of about ten thousand square miles in the State of New York, forming the Adirondacks. The southern limit then runs off toward Lake Huron, whose east and north shores it forms, and then continues on, as before stated, to the Arctic Ocean. We thus see that this great V shaped area of Laurentian rocks has its longer arm approximately parallel to the Rocky Mountain chain and Pacific border, and its shorter one parallel to the smaller Appalachian chain and Atlantic border. "Hence," says Prof. Dana, "in the very inception of the continent not only was its general topography foreshadowed, but its main mountain chains appear to have been begun, and its great intermediate basins to have been defined—the basin of New England and New Brunswick on the east; that between the Appalachians and the Rocky Mountains over the great interior; that of Hudson's Bay between the arms of the northern V. The evolution of the grand structure lines of the continent was hence early commenced, and the system then initiated was the system to the end. Here is one strong reason for concluding that continents have always been continents; that, while portions may have at times been submerged some thousands of feet, the continents have never changed places with the oceans." *

These old crystalline rocks give a peculiar character to the scenery wherever they occur, producing, with but few exceptions, a surface covered with low hills having a peculiar rounded contour, quite distinct from the serrated and rugged outlines often seen in hills and mountains

* *Manual of Geology, p.* 160.

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composed of rocks belonging to the newer systems. The rounded outlines of the hills are remarkably well seen from the Village of Chicoutimi, on the River Saguenay, looking toward the north, and also, though in a less marked manner, from Parliament Hill, if one looks across the Ottawa, over the Townships of Eardly and Hull, which, together with the neighbouring Townships of Wakefield, Templeton, Portland, etc., are composed almost exclusvely of these Laurentian rocks, affording us here in Ottawa abundant material for their study.

The most important and by far the most common of the rocks composing the Laurentian System is that which is known by the name of gneiss. This term originated with the Freiberg miners, who from ancient times used it to designate the rock in which the veins of silver ore occur, and more especially such parts of the rock as were much decomposed. As now employed it denotes a foliated rock composed of quartz, and orthoclase feldspar, which later, however, is sometimes replaced in part by plagioclase feldspar. Hornblende, pyroxene, mica and garnet are also common constituents, and in many cases form a considerable proportion of the rock. The so-called fundamental gneiss of the north-west of Scotland, for instance, is, according to Zirkel, principally hornblende gneiss, that is to say, contains hornblende in addition to quartz and orthoclase, and* as in the case of the corresponding member of the family of the granites, this variety, rich in hornblende, contains sphene, a mineral often found abundantly in our apatite openings. Gneiss, like many of the eruptive rocks, is seen, when thin sections are examined by means of the microscope, to contain very numerous minute acicular crystals of apatite; little zircon crystals and little particles of iron ore are also very common, and these three minerals, as a rule, possess much better crystalline forms than the other constituents of the rock. The rock, as before stated, is foliated, that is, the constituents are arranged in more or less parallel bands. In these bands one mineral preponderates, but does not, as a general rule, prevail to the total exclusion of the others. When mica is present the leaves are arranged parallel to one another, thus giving the rock a more or less easy cleavage along this plane. Gneiss

* Diemikroskopische Beschaffenheit der Mineralien and Gesteine, p. 465.

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may be either coarse or fine grained and of various colours, generally some shade of red or gray. Differences in texture, as well as in composition, give rise to varieties. Thus, for instance, there is schistose gneiss in which the mica forms continuous, thin, parallel, even lamellae, which separate the granular layers composed of quartz and feldspar, "granitoid gneiss, in which the foliation is very obscure and the rock somewhat resembles granite," and "augengneiss," or eye gneiss, in which large individuals of orthoclose are embedded in a somewhat lenticular shape supposed to resemble an eye.

The great beds of limestone, which, as mentioned above, are often interstratified with the gneiss are generally white, but sometimes have a greyish, pinkish, or salmon colour. They are generally coarse grained, but sometimes saccharoidal in texture, and usually contain a number of accessory minerals. In Dr. Hunt's memoir on the Laurentian limestones of North America he enumerates no less than fifty-four mineral species occurring in them. These minerals, especially when found in limestone veins, are frequently well crystallized, and most beautiful combinations are often found, such as bright green apatite, or pyroxene crystals, in a matrix of coarsely crystalline pink limestone. These limestone bands are well exposed in the Township of Hull, and in the Grenville region contain the celebrated Eozoon Canadense.

Associated with these limestone beds are beds of quartzite, hornblende schist, pyroxene rock, garnet rock, etc., often of considerable thickness.

Another class of rocks which are found in many places in the Laurentian system and which are deserving of mention are the so-called anorthosite, labradorite or Norian rocks. These occur not only in Canada but also in Scandinavia, New York, and in the North of Scotland. In Sweden, where they have been most carefully studied, they are in part, undoubtedly, true members of the Laurentian system, while some of the more granitoid varieties are undoubtedly intrusive rocks. They are characterized by the predominence of plagioclase or lime soda feldspar, the frequent occurrence of hypersthene and pyroxene, and the almost entire absence of quartz. A strange but very important fact in relation to these rocks is that, in America at least, the iron ores associated with them are always so far as we at

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present know titaniferous, the percentage of titanium being as a general rule too high to permit of them being employed for the production of iron.

In the Geology of Canada published in 1863, Sir William Logan gives as the result of his study of the Laurentian system in the Grenville region the following section through the series, arranged in ascending order :—

		feet.
1.	Orthoclase Gneiss of Trembling Mountain, probably exceeding	5,000
2.	Trembling Lake limestone	1,500
3.	2nd Orthoclase Gneiss	4,000
4.	Green Lake limestone with bands of gneiss and garnet rock	2,500
5.	3rd Orthoclase Gneiss	3,500
6.	Grenville limestone with bands of gneiss	750
7.	4th Orthoclase Gneiss	1,580
8.	Proctor's Lake limestone	20
9.	5th Orthoclase Gneiss, passing into anorthosite	3,400
10.	Anorthosite, thickness wholly conjectural	10,000
		32,250

Mr. H. G. Vennor, who, while connected with our Geological Survey, studied these rocks for many years, commencing his investigations in the district about Hastings County, Ontario, and continuing them northward across the Ottawa into Ottawa County, and who also studied them in the anorthosite area north of Montreal, has recently given to Dr. Selwyn a condensed statement of the results of his investigations. He divides the Laurentian system into three subdivisions. The lowest of these, which he calls Division *A*, is a great mass of syenitic gneiss, generally deep red in colour and is destitute of crystalline limestones and mineral deposits. This probably is equivalent to the lowest or Trembling Mountain gneiss of Sir William Logan's section. Following this in ascending order is a series of hornblendic and pyroxenic rocks, diorites, anorthosites, etc., constituting his Division *B*, and which is in its turn overlayed by another series of gneisses, which, however, are associated with numerous bands of crystalline limestone, and contains great deposits of graphite, apatite and iron ore. Mr. Vennor believes Divisions *B* and *C* to be comformable to one another and to overlie Division *A* unconformably. Division *B* and *C* form but a small portion of the whole series and occur merely as a

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border or rim around immense areas of the older gneisses of Division *A*. Both *B* and *C* carry iron ores; those of *B* being finely crystalline, while those of *C* are coarsely crystalline. If these sub divisions prove to be correct, and the lowest or Trembling Lake gneiss belongs to Division *A*, the upper gneisses and limestones of Division *C* would in the Grenville region have, according to Sir William Logan's measurements, a thickness of about 15,000 feet.

In Bavaria the Laurentian has been found to have a thickness of not less than 90,000 feet.

In closing, let me say a few words on the various views which have been put forward to explain the origin of this immense series of crystalline rocks which we have just been considering, asking you to bear in mind that here we leave the domain of fact and enter that of hypothesis. As yet comparatively little is known of the great Archaic System as a whole, and every new investigation yields rich and unexpected fruit. Although, as Dr. Kalkousky remarks, * it is very difficult to make our observations on these rocks completely objective, yet that is the aim which we should have in view, and we may then hope, after long continued, careful and thorough investigation, to be able to decide with a high degree of probability as to the method in which this great system of rocks originated. Of all the theories hitherto put forward to account for the genesis of these crystalline rocks, no single one is in a position to give a satisfactory answer to all questions regarding them, and, as Nauman well says,—the real mode in which these primitive rocks were formed is still involved in such obscurity that they may with perfect justice be termed cryptogenous rocks.†

Speaking generally, there are at the present time three hypotheses maintained by different schools. According to the first of these the rocks in question are the first solidified crust of our planet. The foliated structure and banding not being due, like the bedding in more recent formations, to aqueous deposition, but to agencies at work in the cooling of a fluid mass, the earth as is usually supposed having been formed by the gradual condensation of a mass of fiery vapour. We know that

* Ueber die Erforschung der archäischen Formationen—Neues Jahrbuch für Mineralogie, etc., 1880, II p. 1.

† Lehrbrich der Geognosie—Zweiter Band s. 155.

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many undoubtedly igneous rocks have a more or less well defined banded structure and parallel arrangement of the constituents, induced by the movement of the rock while in a liquid or viscous state. Some such motion it was thought might produce the foliated structure seen in these gneisses and allied rocks. Of course since the earth is supposed to have solidified first at the surface, the higher members of the series must be older than those on which they rest. This hypothesis found many illustrious supporters, but does not by any means satisfactorily explain the repeated alterations of different varieties of gneiss, limestone quartzite and other rocks, seen in the Laurentian system.

Dana, in 1843, * put forward a modification of this hypothesis. He supposed that gneiss and mica schist bore to granite a relation somewhat similar to that which volcanic tuff and debris bears to our modern lavas. He saw in these rocks the products of great volcanic eruptions which took place under great pressure at the bottom of the ocean and which were compacted and altered by the action of the superincumbent waters highly heated by the eruption. The enormous extent and thickness of the primitive formations and their occurrence, frequently quite independent of larger granitic masses, do not favour this view. Dana himself subsequently saw reasons for rejecting it, and says of the Laurentian rocks in his Manual of Geology published in 1875 :—" The alternations of hornblendic and other schists, with quartzite, limestone, gneiss and other rocks, prove that all were once sedimentary beds, beds formed by the action of moving water, like the sandstones, argillaceous beds, and limestones of later times. They have no resemblance to lavas or igneous injections." And again " these Laurentian rocks are made out of the ruins of older Laurentian, or of still older Archœan rocks, that is, of the sands, clays and stones made and distributed by the ocean, as it washed the earliest formed crust of the globe." The second hypothesis has been ably advocated by Dr. Sterry Hunt. It agrees in some respects, though differing in others, with the old neptunian theory of Werner. Werner taught that all rocks, eruptive, crystalline and sedimentary, were deposits from the waters of a primeval ocean. According to this theory all silicated, stratified rocks, and pro-

* American Journal of Science—1843, p. 105.

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bably to a certain extent the limestones as well, have not originated from the alteration of either ordinary aqueous sediments, or of volcanic materials. Furthermore, to use Dr. Hunt's words, the "conditions under which these rocks were deposited and crystallized, whether in shallow waters, or in abyssal depths (where pressure greatly influences chemical affinities) have not been reproduced to any great extent since the beginning of palaeozoic time," and "the eruptive rocks, or at least a large part of them, are softened and displaced portions of these ancient neptunian rocks, of which they retain many of the mineralogical and lithological characters."* Although, according to Dr. Hunt, the conditions under which the crystalline rocks were deposited are not reproduced at present on the earth's surface to any great extent, yet we see the same processes going on in a much less energetic form in the action of the thermal waters of Plombieres and other localities in France, on the masonry of the old Roman baths. Various minerals, such as apophyllite, scolezite, opal, etc., have been formed by the action of the heated waters on the constituents of the concrete, and are found filling cavities in the bricks, as well as interstices in the cement. Daubrée considers that the lime, alumina and silica of the minerals so produced have been derived from the mortar and the bricks, while the water has chiefly furnished the alkalies. These changes have taken place at temperatures not above 70°. The production of the crystalline rocks at a temperature as low as this does not preclude the possibility of the existence of life on the planet in this early time, indeed Dr. Hunt has argued that in the occurrence of great beds of iron and graphite in the Laurentian, we have evidence of at least an abundant flora. The process supposed by this theory would probably find an analogue in the agencies at work in the formation of mineral veins.

According to the third hypothesis, which is at present very generally held in England and America, owing largely to the commanding influence of Zell, though not originated by him, the crystalline rocks under consideration may be of various ages, in some cases comparatively recent, but have undergone changes subsequent to their deposition, often metasomatic in character, which have caused them to become

* The History of some Pre-Cambrian Rocks in America and Europe, p. 3. See also, Chemical and Geological Essays by the same author.

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thoroughly crystalline, obliterating at the same time any organic remains which they may have, and in many cases probably did contain. In any great region of crystalline rocks, although now tolerably constant in lithological characters, there may be, according to this theory, alteration products of rock, of various ages; and the same great series may in one part of its distribution be represented by uncrystalline fossiliferous sediments, and in another by thoroughly crystalline rocks, such as gneiss or hornblende schist. Two ways have been suggested in which this alteration might take place. 1st. The alteration has, according to Zell, been induced principally by the internal heat of the earth acting on deeply buried sediments, or, 2nd. According to Bischoff, the alteration may have been due, not primarily to any recrystallization by heat, though this may also have helped to effect the change, but to the action of percolating waters from higher levels holding salts in solution, and acting either at ordinary temperatures or at temperatures higher than we ordinarily experience at the surface of the earth. According to this theory, we might have the same bed of limestone, according to the nature of the circulating mineral solutions, in one place altered into pyroxenic or amphibotic rock, in another into a garnet or epidote rock, and in a third into a quartz-feldspar rock.* It is, of course, supposed that the action has been continued through immense periods of time, but, although the time which has elapsed since the Silurian is enormous, it is not to be taken into account in this connection, since in the case of *our* Laurentian, at any rate, the metamorphism must have been completed before the Huronian rocks were deposited, since, the latter in many places hold rounded pebbles of the former, undistinguishable from the rock as elsewhere found in place. Those who now hold this theory generally consider that both the interior heat of the earth and the action of percolating waters have played their part in the alteration. Some remarkable experiments on the effects produced in solid bodies by the action of great pressure, lately made by Spring,† throws much light on a possible method of the crystallization of sedimentary rocks. Among numerous other interesting results, he found that peat, when submitted to a pressure of 6,000 atmospheres was converted into a hard

* See Credner. Elemente der Geologie p. 213.

† Bull. de l'Acad. Royal des Sci., etc., de Belgique, 1880, 2nd Ser. vol. XLIX.

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shining black mass, with exactly the appearance of coal and the scaly structure which coal possesses. Coal, under a pressure of 6,000 atmospheres, was moulded with ease. Precipitated alumina, dried at a temperature of 140°, became fluid under a pressure of 5,000 atmospheres. Many chemical reactions were also induced by pressure, for instance, copper filings and sulphur, when mixed together and submitted to pressure, united, forming a crystalline black sulphide of copper. A mixture of chloride of mercury and copper filings at a pressure of 5,000 atmospheres underwent a change into chloride of copper and mercury. Amorphous iodide of mercury under a pressure of 4,000 atmospheres became compacted into a block, showing, under the microscope, a mass of translucent crystal fragments. It thus appears that great pressure alone can, in certain cases, at least—1st, soften, and even melt solid bodies (coal, peat, alumina); 2nd, crystallize bodies capable of assuming crystalline form (iodide of mercury); 3rd, induce chemical reactions (chloride of mercury and copper filings). All regions composed of crystalline schists show in the complicated folding and twisting of their strata evidence of having been submitted to tremendous pressure. In great pressure we probably have a very simple and beautiful explanation of many cases of regional metamorphism. In order to be so altered, however, the original rocks would have to contain all the elements required for the production of the resulting crystalline schists, since by pressure alone the change could only be one of diagenesis.

FISHES OF THE OTTAWA DISTRICT.

H. B. Small.

Note.—*The nomenclature adopted is taken from Jordan and Gilbert's latest synopsis of the Fishes of North America.*

The fishes of Canada and especially of this district, present a field of observation as yet very partially travelled, and one that will repay minute investigation. Not only are there doubtless species as yet unobserved and undescribed, but a more careful description and comparison of those already noted will contribute much to the progress of

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this branch of science. The Annual report of the Commissioner of Fisheries of the Dominion contains much information valuable to the statistician and to the mercantile community, but is scarcely adapted to the wants of the naturalist, and it is not to be expected that such reports should do more than furnish records of fisheries carried on for commercial purposes in various districts. In this connection I may state that the report of 1881 enumerates the catch of fish during the year by divisions or districts, but only mentions those best known as marketable. For instance in the Upper Ottawa and Gatineau division it gives the yield of trout, whitefish, bass, pike, pickerel, maskinonge, sturgeon and mixed fish and the number of eels. The value is not given, but by putting the lowest estimate on the yield I find that it represents nearly $25,000, and it will be safe to add to that at least $15,000 for the catch of other waters of this district, making a total value of $40,000.

I much regret that my own personal observations in the Ottawa district have been limited, but such as they are I give them.

I am indebted to the President of this Club, Mr. Fletcher, for reference to lists published by the Ottawa Natural History Society of 1859—1863, which are in his possession, and in which certain fishes are mentioned as belonging to the Ottawa district, but presumably that meant the Ottawa River generally. They do not comprise all the fish I now mention, and they allude to three of which I am very dubious, viz.: The ribbon fish, the splendid pike and the red-bellied minnow, enumerating each of these as a different species. They also mention the shad, to which, however, I shall allude in its proper place. The existence of these lists shows how interesting for reference in after years may be a compilation, which at the time seems unnecessary, and I would here remark how useful it would be if each naturalist were annually to keep a record of all he sees, confining himself to the branch he most delights in. This has been done as regards birds and the dates of their arrival here in spring, and it could easily be extended to other branches of natural history. All records are useful, sooner or later, if properly kept, and many a little incident, trifling as it may seem at the time, might prove of great value in determining some question that may arise at a future period.

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First of all comes the Perch family, of which the common or yellow perch (*Perca Americana*), closely resembling its European name-sake, abounds in both lake and river, pond and stream, varying considerably in size and colour, according to locality and food. Three pounds is the extreme weight I have heard of, but a one-pound perch is a large specimen ordinarily. A lake near Buckingham, known as Donaldson's Lake, is full of very fine perch and of good quality, and is perhaps one of the best fishing grounds near here for this species. Spawning in autumn, these fish recover so as to be in fine condition in the early spring and even in the winter, when they may be taken in large quantities through the ice. The sharp-nosed perch (*Percina Caprodes*) is much rarer, but is abundant in the Rideau Canal, and is met with in the Rideau and Ottawa Rivers, and their tributaries occasionally. It's distinguishing features are chiefly the sharpness of its nose, long and narrow body, and some seven dark vertical bands, with an equal number of spots or irregular bands. DeKay doubts it being a different species, and thinks it only a variety. It attains no size, seldom reaching more than three or four ounces in weight.

The Doré, yellow pike perch, or glasseye, often erroneously called pickerel (*Stizostedium Vitreum*) is abundant in our waters, and though its habits and form suggest the idea of a pike, it is really more of a perch. It is very voracious, excellent eating, frequents the foot of rapids or eddies in rapids, and is easily taken with a spoon or live bait. Large specimens reach from 8 to 10 lbs. weight, but 4 lbs. is an average size. It is more abundant in rivers than lakes, only frequenting the latter where streams enter them. Long trolling lines are far more successful than short ones for this fish, as it has been proved that the bait will be seized three times on the long line to once on the short one. The Canadian Doré (*S. Canadense*) ranging from 1 to 4 lbs., with a few pale yellow spots below the lateral line, and the grey Doré (*S. Griseum*) of a greyer colour than the two preceding, seldom exceeding a few inches in length, are found where the common Doré exists, but not so abundantly. They are met with in the Rideau, Ottawa, Lievres and Gatineau Rivers, the grey Doré being plentiful in the Rideau River.

The Tessellated Darter (*Boleosoma Olmstedi*) is a small fish, never exceeding more than 2 or 3 inches, and is very little known from

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a habit it has of lying on the bottom. It has a series of black spots on its back, and another series along the lateral line. It frequents clear springs or streams, lying for a while perfectly still at the bottom, and then darting off with great velocity after its prey or in sport. I have found it in clear pools and in several shallow streams in this vicinity, and have watched their curious habits in my aquarium.

The Rock Bass *(Ambloplites Rupestris)* is well known in all the streams and rivers of this locality wherever large stones abound, or at the foot of mill races and in the back waters of eddies. Its extreme weight ranges from one to one and a half pounds. It readily takes the hook, biting eagerly at worm, minnow, or cray-fish, especially the latter. It also rises to the fly, especially in the dusk, either morning or evening.

The Black Bass *(Micropterus Dolomien)* ranks high among the game fish of this vicinity, and is found in most of the waters around here. A distinguishing feature over all other of its congeners is a red speck in each eye like a dot of carmine. When fully grown its length is about 15 inches, and its weight ranges from one to five or six pounds. It differs much, not only in colour but in form, according to the water it frequents. It is a very active fish, and when hooked often leaps violently out of the water. It generally lies close to the bottom in still water, or is found frequenting the foot of rapids. Both the rock and black bass exhibit what may be called a parental affection for their helpless offspring when they first appear, and are very tenacious of the spot they have selected as a breeding place, sailing back and forth to keep off all other finny intruders. I have often noticed a circular sandy space amidst stones at the bottom of a clear pool in our rivers, with a pair of bass hovering over it. These bare places are where the spawn is deposited, and may be accounted for by the fish having removed all obstacles, rolling them to one side or the other either with the mouth or by rubbing their belly backwards and forwards over the spot, and so forming a circular wall or bank. After the young fry appear, the parent fish watch them for a few days till they are strong enough to hide themselves in natural cover, and the hatching place is then abandoned. Numbers of these places may be seen in any pool where bass abound. Whilst watching, if any other fish appear, an attitude of defence is assumed by the erection of the spines of the dorsal fin, and the rigidity

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of the pectorals, when, like an armoured knight of old, the fish after poising itself thus for a moment, makes a sudden charge at the object of its attack, repeating it over and over again till the intruder withdraws. Some very fine black bass are to be found in the deep water of the dam above Hogsback on the Rideau, and in the bays of the Ottawa. The Gatineau and Lievre are too washy for bass to lie there. In the lakes of the Rideau River, and in the lakes of Ottawa County very large ones are caught, Lake Bernard being perhaps one of the most prolific places. A very large specimen was on exhibition in Mr. Esmonde's window last summer, caught in Lake Bernard, and weighing 5 lbs. 8¾ oz., being one of, if not the largest, on record here.

The Oswego or Spotted Bass *(Micropterus Salmoides)* is somewhat similar to the foregoing, but has a larger head and wants the red spot in the eye. The body also is more oval, and thinner. It abounds in the Rideau Canal, and is found in all the rivers here, but more sparingly. Large ones are taken in Leamy's Lake weighing up to 2 lbs. The flesh is watery, flaky, and insipid.

The Sunfish *(Lepomis Gibbosus)* which is said to derive its name from its fondness for basking in the sun in shoal water, is common everywhere except in the sharp running mountain streams of the Laurentian range, and yet I remember once being horribly disappointed when trout fishing below Old Chelsea, at finding after a smart tug at my line in an old disused weir beside an obsolete tannery, a miserable little sunfish instead of the expected trout. It may be called from its colours a very beautiful fish, is lively and active, and as Jardine says, it vies in beauty and brightness with tropical fishes. It is a very amusing subject for an aquarium where it soon asserts its superiority by its boldness, but is very destructive to any soft finned fish therein, persecuting them whenever they approach the quarters it has taken up. In its natural state, individuals will sometimes take up a position under a large stone, or at the foot of a rock, and act as a kind of police for a certain distance on either side, darting out with fins bristling and driving away intruders. A prominent feature about the sunfish is a black spot terminating in bright scarlet on the lower end of the gill cover, and its throat and belly are of an orange and gold colour, with occasionally a blueish tinge in certain lights, from which latter it has

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not inappropriately been compared to the humming bird. A smaller fish, the Pond fish (*Lepomis Auritus*), with a body more robust and thicker than the preceding is found often associated with it, and almost as numerous. Its throat and belly, however, are of a pale whitish colour, and the absence of the scarlet spot on the gill cover is an easy means of distinction. These fish are the joy of the youthful angler, and in catching them it is very questionable if the older disciple of the rod bent only on game fish has half the pleasure of the school boy.

The common Bullhead (*Uranidea Cognata*) is a small repulsive looking fish very little known from its habit of secluding itself beneath stones in sharp running streams. It seldoms exceeds 2 or 3 inches in length, has a broad, flat head, one-third the length of the body, and furnished with two curved spines. The gape of its mouth is very large, and eyes large and prominent, which give it the appearance of looking upwards. Its body diminishes from the head and becomes compressed towards the tail. The only places where I have met with this fish are in a small stream north of Buckingham, and in the Chelsea trout stream. That they are not abundant is evident from the fact that I do not remember ever taking more than four specimens in the two localities in all my fishing experience there, three of which, if my memory serves me right, were in the Buckingham stream. It is doubtless to be met with around here, but is one of the fish that require looking for, and even then is likely to elude ordinary search. It is not improbable that other species of this family, two of which are known in the North-West, may be found here, and this is one of the *genera* that would repay investigating.

The four spined Stickleback (*Apeltes Quadracus*) and the five or six spined Stickleback (*Eucalia Inconstans*) are so common in ditches, brooks and ponds, and especially in Lake Flora in Hull, that they are the object of persecution by every unbreeched urchin who can procure a crooked pin and a yard or two of thread on a willow twig. A peculiarity of this genus is that they do not deposit their spawn on the bottom like other fish, but actually build a globular nest of water weeds and *confervæ* about the size of a musket ball, balanced or fixed between rushes, or in a tuft of submerged grass or aquatic weeds. Dr. Fortin, in his notes on this fish, says, that the building of the nest is

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entrusted to the male, and that several females deposit their eggs in the same nest; that a single male impregnates all the eggs of one nest, and that he has to defend them against the voracity of other fish, and even of the females themselves till they are hatched, his vigilance only ceasing when the young are able to provide for their own safety. Of the accuracy of this I cannot speak with any certainty; Dr. Dawson is inclined to believe that the carefully built nest may have for one of its objects, to guard against the destruction of the embryo in the ova by microscopic animalculæ. The same writer affirms that when irritated or alarmed, it will remain motionless over some part of the bottom resembling its own colour, which it possesses the power of deepening almost into black.

The Sheeps-head (*Haploidonotus Grunniens*) is found in the Ottawa, but is by no means common, though formerly it is said to have been quite abundant. Last summer some very fine specimens were to be seen at the fish stalls, taken from the river near Templeton. Its back is considerably arched, giving it the appearance of a white bass, eyes large and mouth small. A peculiarity about this fish is that the first ray of the spinous or prickly portion of the dorsal fin is short, the third longer than the second, and so in proportion till the ninth is longest of all. It is sometimes called erroneously white bass and white perch.

The Catfish genus will reward the student's careful examination of every individual that falls under his notice, for the scientific world is yet in doubt as to the number of species that compose it. The channel catfish (*Ictalurus Lacustris*) is met with in the Ottawa River, in the deepest parts or channel, and specimens of it may occasionally be seen in our market of ten lbs. weight and upwards, but a fish of over 4 lbs. weight is a large one for these waters, although in the south and west they attain an enormous size. Its forked tail, one lobe of which is slightly longer than the other, easily distinguish it from the common catfish (*Amiurus Catus*), which is very common in any water with a muddy bottom. A peculiarity about it is that occasionally its ventral fins are wanting. Another strange feature is that in early spring it burrows into the bank and forms a semi-circular dam of mud and clay in front of its burrow, with an aperture to swim in and out of. In this burrow the female deposits her spawn, and the only portion visible outside the

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burrow, is the barbels which are in constant motion. It falls at this time an easy prey to the spear, and to many prowling animals. I find some six other species of this genus described, and I am inclined to think that two at least of them (*A. Pullus*) the brown, and (*A. natalis*) the black catfish, exist in the waters round here.

The Chub Sucker (*Erimyzon Sucetta*) or small chub, is common in rapid dashing streams especially in the south side of the Ottawa, and in the early spring is abundant in the waste water stream from Hartwell's Locks, and in many of our small rapid streams. It is very different from the fish ordinarily known in our rivers as the chub, which will be mentioned presently, and which is really the Roach-dace. The long finned Sucker (*Carpiodes Cyprinus*) seems to be a connecting link between the chub and sucker family resembling both, and is not uncommon.

Of the Sucker family several species frequent our waters here. The common sucker (*Catastomus Commersoni*) attains a weight of from 3 to 4 lbs., but its flesh is soft. It is one of the first fish that can be caught in spring. The rock Sucker* (a variety) has a firm flesh, and is freer from small bones. It is found in the shallows of the Rideau and Ottawa and in the Gatineau, and attains a weight of 5 or 6 lbs. The pale Sucker* (a variety) runs up the sluggish streams from the larger rivers as soon as the thaw sets in in spring, but is insipid. The long nosed Sucker, (*C. Longirostris*) is a smaller fish seldom exceeding 5 or 6 inches, frequenting the smaller streams, and is sometimes called the brook-sucker.* It is very useful in an aquarium, where it acts as a scavenger, clearing up the refuse of other fish. A curious habit it possesses is drawing in by suction a small portion of fine clean sand from the bottom, and transporting it to another part of the aquarium where it deposits it by blowing it out and then returning for more. The horned Sucker (a variety) is found in our rivers, but is not so abundant as the other species. It has a number of tubercles on its head (hence its name) the use of which is not apparant, but which are thought to be merely a sexual distinction. The large scaled Sucker (*Moxostoma Macrolepidotum*) is taken in the Ottawa, and attains a weight of 7 or 8 lbs.

* These are local names.

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It is easily distinguishable by its large scales, firm appearance, and closely resembles the carp of Europe. It and the rock Sucker are the two best fish of the genus for eating.

The Roach Dace (*Semotilus Bullaris*) is the fish erroneously called chub; it is abundant in the rapids of all our rivers where it affords good sport, taking equally well a worm, a fly, or a grasshopper. Its average full size is from 1 to 1½ lbs. in weight. The Redfin or Rough head (*Minnilus Cornutus*), frequents deep holes or pot-holes of rapid streams associated with brook trout. It has a leathery mouth, and is abundant in the Gatineau, Blanche, and all tributaries of large rivers. It is plentiful in the pools of the Chelsea trout stream where the water is still and muddy bottomed, and is very destructive to the ova of trout. Numerous tubercles on its head give it the appearance of being covered with minute prickles. It is sometimes called horny dace or horned chub. The black nosed dace (*Rhinicthys Atronasus*) known generally as the brook or striped minnow is abundant. This fish sometimes has a rich orange colouring on its belly, and in some specimens this is so sharply marked as to have given rise to the idea of the existence of a different species to which the name of red bellied minnow (*Chrosomus Erythrogaster*) has been given. In an Ottawa paper of 1866 is an article entitled "Notes on the lakes and lake fishes in the vicinity of Ottawa, by a member of the Isaac Walton Club," the writer of which, I fancy, was the late Dr. Van-Cortland. As the first part treats of this fish, I quote it here:—"In the Village of Hull, immediately behind the drying grounds of Eddy's pail factory, deep seated in a rocky crater, there is a sheet of water which although only about two acres in extent has acquired *par excellence* the name of Minnow Lake. Until lately, and since the adjacent ground has been built upon and so disfigured by those tinder boxes which constitute Wright's Town, it was a most beautiful and inviting object to look down upon from the surrounding cliffs, which on the eastern side rise perpendicularly to a considerable height, the highest portion of the rock being some 70 feet above the water. During the spring freshets an imperfect communication is effected by a sluggish outlet with Brigham's Creek which it taps at the natural cave just behind the stone house at the old distillery causeway, but which in the summer season being nearly dried up, answers another and a very different purpose, namely,

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that of securing an inviting retreat for the innoxious ringed water snakes which in great numbers glide all gracefully amongst the ramification of its dank sub soil. The fish from which the lake, or rather pond, takes its name are not true minnows but the black nosed dace, which literally swarm in its waters. They are daily captured in hundreds, and yet without any apparent diminution in their numbers. Together with them, but in much smaller quantities, is found a very beautiful little fish, and whose location, as far as I have seen, is limited to this circumscribed basin, the scarlet bellied minnow (*Leuciscus Erythrogaster*). They are taken either with a minnow hook or dip net, and when placed in an aquarium as objects of attraction, are not far behind their well known congeners the gold fish. In their habits they differ from their other lacustrine companions, inasmuch as they descend into the deep water much earlier and rise again to the surface later in their respective seasons." Now, I think this fish is only a variety of the blacknosed dace, and I have taken similar fish in the quarries near Montreal, and had them in my aquarium. The shining dace (*Minnilus Rubellus*) known also as the white minnow is abundant, and its young or small fry are the fish which throng the edge of wharves, and shallow water below locks, where they can be taken abundantly with the scoop net. A very small dace (*L. Pigmoeus* ?) pigmy dace or small minnow is very abundant in shallow water, where it is frequently left high and dry after floods in large numbers.

The Shiner, (*Notemigonus Chrysoleucas*) is a very handsome fish, with a brilliant lustrous white or golden tinge all over it. Its scales very easily rub off in handling. It is an ornament to the aquarium. It is found in all our streams in calm water, but is not very abundant, it being eagerly devoured by fish of prey and proving a tempting bait.

Of minnows proper there is only one species, the black minnow or barred minnow (*Umbra Limi*). These fish are very tenacious of life. They are not as abundant here as in the St. Lawrence, but I have found them in the clay pits near the Rideau River, and in the lagoon east of the canal near Hogsback, as well as in small streams running into the Lievre and Ottawa Rivers. These fish partially bury themselves in the mud in dry weather and are very hardy. They possess a peculiar habit of balancing themselves in midwater, with the

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pectorals in perpetual motion, and will at times dart violently to the surface and down again instantaneously, remaining a long time without going to the surface to respire. They are an excellent bait for bass fishing.

The Pike (*Esox Reticulatus*) is a well known fish everywhere, but it is an undecided question whether the pike of this country and of Europe are the same, or different species. I think, however, there is very little essential difference. What has been styled in this country as a different species of pike, namely, the splendid Pike (*E. Phaleratus*), is, I believe, the ordinary pike in various stages of growth. Another species, the northern Pike, (*E. Lucius*) is met with here occasionally. It is a noticeable fact that the dorsal fin of the pike is placed very far back, thus greatly facilitating his movements through the weeds. There are two peculiarities connected with this fish not perhaps generally known, the one that he is during the summer particularly listless, basking near the surface, when no bait, however tempting, can allure him; in fact he rather retreats or backs from it. Now, at this period, small fry are commencing their active existence, and this listlessness looks like a marked feature in fish economy, for the small fry at this time swim around him with apparently total unconcern. These remarks refer more particularly to pike in shallow water, as in the lakes and deep rivers this habit is not noticeable. The other peculiarity is that during the fall it spends the daytime in deep water, and at night in the shallowest water along the shore, frequently coming so near land as to display its fins. What its object in so doing can be is hard to say: some think it is to enjoy the warmer temperature of the shallow water, and others think it is for the purpose of watching for and capturing small land animals that come to the water's edge at night. It cannot be for spawning, as that takes place in spring. I am rather inclined to the belief that its object is to rid itself of parasites, by rubbing on gravelly bottoms and shoals. There is much confusion between the pike and his cousin the Maskinongé (*E. Nobilior*) for which overgrown pike are often mistaken, but any person who has seen the two fish alongside can always afterwards distinguish them. Its mandibles are larger than those of the pike, tail more forked and larger, or lunate, while that of the pike is bilobed, back of a dark grey, and its sides lighter and

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blotched with black. Its flesh is much firmer, and it attains the largest size of all fish in this district, if we except the sturgeon. It is found in the Ottawa and Rideau Rivers, and in the Canal, and in the lakes connected with the Gatineau and Lievres Rivers. Its name is said to be derived from the Ojibway (*Maska nonja*), long snout; the early French settlers called it (*masque langue*), or long visage. Ordinary bait presents no attraction in the larger fish, and a fish of one or two pounds should be used to catch the large ones, or a spoon twice the size of those ordinarily used. Near the Quio is one of the best fishing grounds for this fish, but very large ones are taken in the Rideau. Mr. Lapointe tells me the largest maskinongé he has ever offered for sale was 42 lbs. Pike equalling in weight the largest maskinongé are recorded by early writers, such as that described by Pliny, taken in the Rhine, which weighed 1,000 lbs. and was caught with a hook attached to a chain (*catenato hamo*) and drawn out by oxen (*boumjugis*). That fish surely must have been a sturgeon, and if weighed, the scales must have been of doubtful veracity!

Whether the common Salmon (*Salmo Salar*) was ever abundant in the Ottawa River prior to its sawdust and mill refuse pollution is a question on which history is silent, as far as any authentic data can be given; but that they did frequent it there is no doubt, as the name Salmon River was retained by a small tributary near Montebello, long after the native fish had abandoned its waters. A few years ago experiments were tried for restocking that stream by artificial means, and our worthy Commissioner of Fisheries interested himself largely in the undertaking. For the first two years after the young fry had been turned out, there was every promise of success; the young fish were healthy and grew perceptibly. The third year, however, was one of great drought, and although during the spring and early part of the summer several small salmon were found in the fishermen's nets, later on the water fell so low and became so warm that no fish of the salmon tribe could live, and in the following year they seemed to be extinct. The venture however was again tried, and for two seasons numerous small salmon in various stages of growth were seen. In the fall of the second year, misfortune again doomed the fish to destruction. There was at the head of Salmon River a lumber dam which backed the waters of the main stream into a long swampy strip, separating the

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stream from a neighbouring group of lakes for the purpose of filling the channels to float logs down to the Ottawa River. A wire grating was placed across the mouth of the main water-course, and a gate with a wire screen was fixed in the dam to keep out the coarse fish abounding in the drowned land and small lakes. These barriers were removed in the fall by some mischievous hand, and the river below soon swarmed with fish of prey. On one day in the following summer, Mr. Whitcher informed me he killed some 40 pike in the stream, and out of one fish of about 6 lbs. weight he took 17 young salmon of small size. Finding it impossible to rid the river of its new inhabitants, no attempt to restock it has been made, but the fact was abundantly proved, that if unmolested, salmon would live and thrive there.

Mr. Whitcher has subsequently reared in small ponds on his own grounds here, California and Lake Ontario Salmon, and his experiments with them are of great interest. In three years they have grown from 1 to 10 inches, but he says they seem stunted in growth and their taste is insipid. At certain times the instinct of migration is strong upon them, and they then constantly endeavour to escape from their enclosures, by leaping out on to the grass on the side nearest the Rideau River, the ponds being near the latter, as if they knew that their means of migration lay in that quarter.

Of the brook trout of this district, only one species is acknowledged, but I am inclined to think that there are really several species in existence here if properly examined; yet a careful investigation might show they are only varieties. The common trout (*Salvelinus Fontinalis*) is well known in the lakes and small rapid streams of the Laurentian Mountains; its belly is a silvery white with vermillion dots and yellow spots in the vicinity of the lateral line. Its flesh is white. The red bellied trout (*Salmo Erythrogaster*) has its sides of a bronze colour with rich salmon colour spots, intermixed with crimson, belly of brilliant reddish orange, and its flesh an incarnate red. It has been confounded with the ordinary brook trout and looked upon as only a variety, but, independent of other considerations, DeKay says, the regularity and brilliancy of its colours renders it proper to designate it by a distinct specific name. Jordan considers it only a variety. Various causes have been assigned for the great variety

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of colour in individuals of both species, one being difference of food, and another of water; the latter probably has the most to do with it, as we know that trout that inhabit ponds or lie in deep pools under cover, are dark coloured externally, and those in clear streams running over sandy bottoms, are light and vivid of colour. Trout, moreover, inhabiting still, sluggish waters, dams and lakelets, are of stouter proportions than those of rapid, tumbling streams. The difference is remarked by all who have fished the waters of Ottawa County, those of the lakes being deep of body and proportionately short, while those taken in the outlets are longer and afford more sport when hooked. No trout are found in the waters south of the Ottawa, east of the Chats, where the Laurentides cross the river, whilst above that they abound in the streams on both sides. I have as my authority the late Dr. VanCortlandt for stating that though they have been placed in streams on the south shore, they never lived there any time. The reason for this probably lies in the fact that from the different geological formations of the country on the two sides of the Ottawa, the streams to the south are more liable to be filled with surface water which the trout cannot endure, and neither are they ordinarily as limpid and pure as the mountain streams and lakelets.

Of the Lake or Salmon trout in this district little is really known as to species. I can only find one kind alluded to as abundant, namely, the lake Trout, (*Salvelinus Naymacush*) which is found in most of the larger lakes in Ottawa and Pontiac Counties, and occasionally in the Lievre and Gatineau, but always near the outlet of a lake. It attains a large size, though its average full weight in these waters is from 8 to 12 lbs. One was brought into Buckingham by some Indians a few years ago, which weighed close on to 30 lbs., and in a paper read before the O. N. H. Society in 1865 specimens of those fish are mentioned from the Opeongo of between 50 and 60 lbs., and a specimen that had been caught that summer in Meach's Lake weighing 23 lbs. There is a trout locally known as the grey trout abundant in many of the lakes north of us, seldom attaining more than 4 or 5 lbs. weight. I am firmly of opinion that several species of lake trout inhabit our waters, and that it only requires examination of distinguishing features to define them. All the lake trout lack the

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activity of brook trout, and afford but little sport when hooked. Spearing in autumn, when the fish come in the shallows to spawn, threatened not many years ago to extirpate them entirely in some of the more accessible lakes, and I have known of parties going up to Whitefish Lake on the Lievre for that purpose, who returned with several barrels as their spoil. Thanks, however, to the watchful supervision of the Government, spearing is an evil of the past, or at least nearly so, and there is a prospect of our lakes again becoming productive.

The Whitefish (*Coregonus Clupeiformis*) is found in many of the lakes of the Gatineau and Lievre district, where it is both netted and speared, as it rarely takes a bait, and I have never heard of an instance of the true whitefish being thus taken. Its food consists principally of aquatic algœ and small molluscs. I have found remains of the *cyclas* in the stomachs of some I have examined. This fish is too often confounded in name with a fish caught abundantly in the Ottawa in summer, but which is really another genus, heing a fresh water herring, or moon-eye, (*Hyodon Tergisus*). This fish affords excellent sport in July and August, taking a grasshopper and worm eagerly. It is very similar to, but smaller than the lake herring (*Hyodon Alosoides*), which is one of the fish of this district, and generally called by the ordinary name of Whitefish.

The Shad (*Alosa Sapidissima*) is another fish which is of doubtful question as coming up the Ottawa above Grenville. They are well known as frequenting the Ottawa up to Carillon, but above that only a stray fish once in a way probably ascends, and the beds of sawdust which extend everywhere above Carillon would hardly invite these delicate fish to pursue their wanderings any further. I find the shad recorded in lists of 1860, but then there was no limit assigned to these lists, simply "fishes of the Ottawa."

We now come to one of the most curious fish peculiar to the waters of this continent, the Gar-fish (*Lepidosteus Osseus*). It is found in the Ottawa River and its tributaries, although far more abundantly in the former than the latter. It is the best living exemplification of the old fossil bony scaled ganoids of Agassiz—fishes clad in a complete suit of enamelled armour, which, beginning in the Devonian

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geological system, attained their maximum in Mesozoic times. Hugh Miller in his lectures on geology says, "It would almost seem as if the lepidosteus had been spared amid the wreck of genera and species, to serve as a key by which to unlock the marvels of the icthyology of those remote periods of geological history appropriated to the dynasty of fish." The manner of seizing their prey differs from that usually observed in fishes and resembles that of reptiles; instead of taking their food at once with open mouth, they hold it crossways until by a series of movements it is placed in a proper position for being swallowed in the manner of alligators and lizards. The ball of food is also seen to distend the body as in snakes. The vertebral column of this fish is more perfectly ossified than in any other existing species, and the vertebræ are remarkable as being *opisthocœlian* in type, *i.e.*, hollow behind and convex in front. Its scales are thick, smooth and firmly attached to each other by their upper and lower margins, and of a stony hardness, in fact a perfect coat of mail so thick as to be impregnable to the spear. The jaws are much elongated like the snout of an alligator or a porpoise, and both are furnished internally with rasp-like teeth, and a row of long pointed teeth along their edges. The jaws are hinged together similar to those of the alligator, with the ball and socket jointure. It is a formidable fish and very destructive in its habits. The fishermen when they haul it in with their nets invariably kill it and throw it away. In the young of this species the lateral line is strongly marked and a curious protuberance is visible at the end of the snout. These peculiarities have caused it to be described as a distinct species (*L. Lineatus*), but this is an error. The gar fish was noticed by Charlevoix, who says they not only prey upon fish, but also birds, and he thus describes their mode of capturing them. I give his own description as translated: "Concealing itself among the reeds growing in the marshy border of a lake or river, he thrusts his bill out of water in an upright position. A bird wanting a rest takes this for a broken bough or reed and perches upon it, the fish then opens its mouth and makes such a sudden spring that the bird seldom escapes." The same writer also assures us that the Indians regarded the teeth of this fish as a sovereign remedy for the headache, and that pricking with them where the pain was sharpest, took it instantly away.

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Another curious fish, the Burbot, Methy, Dogfish, Ling or Eelpout (*Lota maculosa*) is found in the bays of the Ottawa, but whether it frequents the river itself I cannot say. I am inclined to think not, as it delights in muddy bottoms and still waters. It is very voracious and destructive to other fish. The candal fin of these fish is almost like a membranous continuation of its body, and with its anguilliform appearance seems to connect other fish with the eel. It attains 2 feet in length. A smaller variety, the lesser burbot, is also found here, but not so abundant, and the only specimen I have come across was a dead one in the lagoon near the mouth of the Lievres.

Eels are abundant, and the common sharpnosed or (*Anguilla Rostrata*) silver eel, so called when taken in running water when it is of a brighter colour, is the only known species here.

Two kinds of Sturgeon frequent the Ottawa, the Lake Sturgeon (*Accipenser Rubicundus*) which ascends the river from its wide lakelike expanses, and the sharp nosed or rock Sturgeon (*Sturio oxyrhynchus*) not so abundant. The bones of these fish are cartilaginous, the back bone, or what would be in another fish the back bone, being a long piece of gristle. The body is studded with rough bony radiated plates and serrated, so that if entangled in a net they are very destructive to its meshes. The flesh of the sturgeon is not appreciated as it should be, as properly cooked it is excellent. Formerly it was called in England the royal fish.

The Lamprey or Lamper Eel (*Icthyomyzon Argenteus*) resembles more in habits the leech, and is a repulsive looking fish in every respect. It has a circular cartilaginous mouth and seven branchial apertures or small round openings on each side of the neck running obliquely from the eyes, in the place of gills. Attaching itself to other fish it draws its nourishment from them by suction, the mouth and tongue—the latter in the throat—acting like the piston of a pump. Dead fish are frequently found with circular wounds on their sides, giving evidence of the cause of death. I think it is not very abundant here, but I have seen it both in the Rideau, Gatineau, the Lievres, and streams running into these rivers. A smaller species, the Mud Lamprey (*Petromyzon Nigricans*) with a cylindrical body compressed at the tail and with sides of an annular or ribbed appearance, might almost be taken for a

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large worm were it not for its very small eyes, and fin which commences near the middle of the back, passes round the tail and terminates at the vent. It likes muddy sluggish streams and may be found under stones and sunken logs. Its length is from 3 to 5 inches.

Such is a brief sketch of the fish of this vicinity as far as observed. As our waters may get more polluted in the course of time from population increasing, or from factories discharging their refuse into them, certain fish now found here may become extinct, and it would be curious to know the cause and the time of such an event. Fish cultivation might be profitably carried on in this district, especially that of Bass, Dore, Maskinonge, and the European Carp, which is now largely introduced into the United States. From experiments made during the past few years at Campbell's Bay, it has been proved that waters along the Ottawa, from which sawdust and mill rubbish are excluded, can be utilized for breeding and rearing fish to an unlimited extent. I am informed that many of the bass now in that bay were brought from the Bay of Quinte, or from the Ottawa lakes, Maskinonge from Rice Lake, and Dore from the Detroit River and from Lake Huron. Campbell's Bay being too limited for more than experimental purposes, a series of ponds in some central part of the Ottawa River would be more desirable, if it ever were deemed worthy to utilize for public use the surplus of fish thus cultivated. Nature seems to have provided for this at the Parker Islands, below Thurso, where with a little outlay separate ponds for separate varieties could be kept apart and under thorough control. In fact Mr. Whitcher suggests that an establishment of the kind would be highly interesting to the public, and as these islands are capable of being laid out into recreation grounds, with walks amidst their shade trees and around their ponds, a natural park easy of access to our citizens by water could be established where the observation of pisciculture could be carried on, and from whose ponds the market supply of the poor but industrious fisherman, who make now but a scant livelihood from the Ottawa River, might be increased.

Before concluding I have another idea to touch upon. For many years I strongly advocated the establishment of a National Museum, which is now being brought to a reality in connection with the Geological Museum, and I cannot help thinking that there might be

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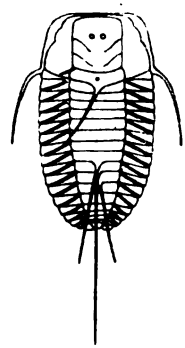
Dendrocrinus jewettii.

Billings 1859

The sculpture of the calyx plates is not preserved in this specimen

Triarthus spinosus.

Billings 1857

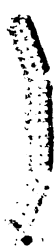


Restored from unpeeled specimens

Heterocrinus bellevillensis

n. sp.

Diagram from another specimen



Side view to show distortion

Front view of the most perfect specimen

Amygdalocystites

Billings 1854

Portion of test of A. radialis Billings 1854 showing position of pores

A. florealis var. laevis n. var. specimen showing pores

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E. Billings & W. K. Billings, del.

A. Grignard lith.

established at the Capital in connection therewith large aquaria for the display of live fishes from this vicinity, and a working model of a fish hatching apparatus. With the aquaria could also be shown stuffed specimens or models of the chief fish of the Ottawa valley, and the extension of the Canadian Pacific Railway westward opening to us the great basins of Nippissing and Temiscaminge, with their rarer specimens, a central figure of fish life might be constituted instructive to naturalists, attractive to strangers, and always interesting to the people of this city and district.

NOTES ON, AND DESCRIPTION OF, SOME FOSSILS FROM THE TRENTON LIMESTONE.

W. R. Billings.

HETEROCRINUS BELLEVILLENSIS, N. SP.—(*See Plate.*)

Cup about as wide as high, tapering from 0·33 inch wide at top to 0·18 inch at the column.

Basals once and a half as wide as high, five in number, pentagonal.

First radials five, the right posterior and the left anterior pentagonal, the anterior heptagonal, the right anterior hexagonal and the left posterior octagonal; the right posterior supports a hexagonal plate with two upper sloping faces, the right of which supports a range of four primary radials and the left the anal series, the left posterior and the anterior each bear three primary radials and the left anterior and right anterior each four, the upper plate in every ray being an axillary.

The first anal plate is pentagonal, and rests principally on the second plate of the right posterior series, but, slightly, on the first radial plate of the left posterior series; following, and within the cup, are first a hexagonal and then a quadrangular plate, beyond which the exact arrangement is difficult to determine.

Arms ten, robust, rounded on the dorsal side and composed of pieces measuring 0·12 inch in width by 0·08 inch in height at the bases, and which taper upwards until, at a distance of 2 inches, they are 0·06 inch in width by a trifle less in height. In two inches of arm there are 34 pieces. The arm pieces are quadrangular, excepting that those

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supporting the armlets are higher on the side of support, and have each an upper corner truncated to provide the necessary bearing for the armlets. The two arms of each ray diverge immediately from the axillary plate upon which they rest, and each arm becomes contiguous with the nearer of those of the adjacent ray; thus five V shaped spaces are formed filled by the armlets which are restricted to the inner side of each arm—a feature unknown in any species of this genus previously described. Each armlet springs from the upper corner of an armplate, those below from every 3rd or 4th, and above from every 2nd plate; on each pair of arms the armlets spring from corresponding plates. The armlets are simple 0·04 inch at their origin and decrease to 0·03 inch in a portion of an armlet 0.9 inch long; the plates are quadrangular, about as long as the adjacent arm pieces, and have a corresponding ratio of reduction.

Column pentagonal, with a central canal of a corresponding shape, but arranged so that the angles of the internal pentagon are opposed to the centres of the sides of the external. There is a line passing from each angle of the canal outwards to the centre of the opposed face and dividing the column into five longitudinal divisions, each of which has a pentagonal section; each dividing line terminates upward under the centre of a basal plate, and thus each longitudinal division alternates with the basals, which also seems to be the case in *Heterocrinus juvenis*, although the division lines of the column in that species* seem to be from outer to inner angle, and the boundary lines of the canal section to be parallel with those of the exterior. The longest fragment of column I have examined is 2½ inches, and I find the distal two inches to be composed of two alternating series of disks respectively about one-eighth and one-quarter the width of column; in the half-inch immediately under the cup both series are thinner, the narrower not being properly disks, as each is composed of five smaller pieces, situated one at each angle.

The specimens used in the description are from the Trenton Limestone of Belleville, Ont., where they were collected by Mr. W. R. Smith.

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*Paleontology of Ohio, Vol. 1, Pl. 1, fig. 3c.

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DENDROCRINUS JEWETTII.—*Billings, 1859.*

Mr. W. R. Smith has kindly allowed me to examine a very handsome series of specimens of this species collected by him from the Trenton limestone at Belleville, where Col. Jewett discovered the fragment upon which the species was founded. Mr. Smith's are the only specimens of this rare species now in Canada, and they show many new points of interest.

The type specimen wanted the arms, but these specimens have them well preserved. As stated in the original description, each of the primary rays consists of one large plate, included in the cup, and four smaller plates above. We now learn further that the secondary rays are each composed of four pieces, the tertiary of seven, the quaternary of six or eight (they appear variable), while two portions of quinary rays have 16 and 18 respectively. Thus this crinoid has at least forty arms.

AMYGDALOCYSTITES.—*Billings.*

This genus was founded in 1854. In describing it the author invariably stated that the plates were solid or non-poriferous.

In the Trenton limestone at Hull, I collected a specimen agreeing with *A. florealis*, excepting that it is smaller than the type specimen and has smooth plates; this specimen has a poriferous test. The pores are circular and arranged on the sutures, half a pore being on one plate and the remainder on the plate contiguous, and there are as many half pores or sulci to each plate as it has sides, the sulci being subcentrally situated on the sutures. On examining the type specimens of *A. florealis* in the G. S. C. Museum, I found the pores distributed precisely as I have stated, *i.e.*, one to each suture, but Mr. H. M. Ami, who at my request kindly inspected the types, found on one a plate near the base bearing a double quantity of sulci. The type specimens of *A. tenuiradiatus* were not sufficiently well preserved to show the pores, if such existed. I discovered that the type specimen of *A. radiatus* had on each suture two pores near the angles and close to the ends of the radiating ridges, the adjacent pores of three contiguous plates forming a group.

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AMYGDALOCYSTITES FLOREALIS *var.* LÆVIS, N. Var.

I propose to separate the Hull specimen as a variety under the name of *lævis*, owing to its smooth plates.

HUDSON RIVER FORMATION CRINOIDS.

I have to record the discovery of *Iocrinus subcrassus*, *Glyptocrinus decadactylus* and *Gl. parvus* in the Trenton Limestone of Brigham's Lake, Hull, where they occur in the same beds with *Glyptocrinus ramulosus*, *Gl. ornatus*, *Dendrocrinus acutidactylus* and other characteristic Trenton forms. So far as I am aware, the three first named have not been recorded from strata of the age of the Trenton Limestone.

THE DUCKS OF THIS LOCALITY.

W. P. LETT.

It is not my intention on this occasion to attempt to offer you anything of a purely scientific character, although it might be no difficult matter in this age of intellectual progress, when standard authorities upon almost every subject of thought are so numerous and so easily available, to deliver a scientific dissertation upon any given theme. From a sportsman's point of view, I prefer, as possibly the more interesting to you and less trouble to myself, to give you my own experience amongst that particular branch of our game birds, the duty of speaking about which has been assigned to me this evening. My experience amongst the wild ducks which visit this part of Canada has been acquired in the bark canoe, amongst the rushes and the rice, and beside the camp fire, where I have passed many a happy day, and many a glorious night—where I have formed friendships which no subsequent combination of circumstances could ever shake. In dealing with our wild ducks, I am quite willing to accord to the canvas-back all the excellences attributed to it, when it has been possible for it to feed upon the roots of the wild celery (*Valisneria*), which impart to the flesh of these fine birds that delicious flavour for which they are so celebrated. After all, however, at the top of the list I feel inclined to place the black duck (*Anas obscura*), not only on account of its size,

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but also for its superiority, taken all round, for the table, as well as for the good sport it affords. The black duck is one of the largest of the many species which visit Canada. It generally makes its first appearance here about the 5th April, and remains throughout the summer and until the latter part of October, when it leaves for the South. Should the autumn be unusually mild and free from frost, these birds remain here longer. Few of them are to be met with in the breeding season, which extends from the 20th May until the 15th August, unless in exceptional cases where the eggs have been destroyed by the raccoon and other depredators. The young birds are then unable to fly, and are much more easily approached than at any other season. The black duck feeds in shallow water near the shores of streams, and may generally be found also in small creeks, lakes, and inland ponds. Its food consists principally of seeds, insects, wild rice, and small aquatic plants; and it is also fond of grain of various kinds. Large flocks often resort in spring to stubble-fields for the purpose of picking up scattered grains of the previous year. This bird never dives when feeding, but, when wounded, if, for instance, a wing has been broken, it is one of the most expert and cunning divers to be found. If one be shot on the wing, and falls into the water, as is commonly the case, unless the sportsman is experienced in the business, and is ready with the second barrel, there are ten chances to one against his getting a sight of the wounded bird after the second dive. Under such circumstances the bird will rise to the surface of the water, and the instant it has taken breath, or has fancied itself seen, it will draw its head under water, after the manner of the loon, and sometimes dive 90 or 100 yards. When wounded, however, the black duck always makes for land, where, its direction having been marked, a good retriever will always be certain to find it. I say always for this reason, I once owned a dog—a cross between a thoroughbred cocker and a retriever—that never failed in any single instance to find a bird that I had either killed or wounded. I recommend this breed of dog to every sportsman fond of wild fowl shooting, as superior in all points to any other, and surpassing immeasurably either branch of the parent stock. The black duck is exceedingly wary and difficult to approach, except on shore where the cover is thick. The least noise, the breaking of a twig, or

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the rustling of dry leaves, puts them on the alert; and sometimes the appearance of a man at three hundred yards distance will cause them to take wing. The only time at which, by observing great caution, they can be easily approached, is at early dawn, when they repair to their feeding places. They are not then so easily alarmed, and after a short flight frequently alight again. At a later hour of the day—and particularly a fine clear day—when startled, they will rise to a great height, and fly a long distance before pitching again. It is invariably more difficult to approach them after having been once or twice alarmed than at first. The flesh of the black duck, if not superior, is at least equal to any of the larger ducks known in this part of Canada. It is very much superior to that of the tame duck; to which latter in voice, size and shape—although like all wild birds, much finer in the lines of beauty—it bears a strong and marked resemblance. The uniformity in plumage distinguishing the black duck gives it, however, a claim to distinctiveness of species, although it may not be improbable that it has a right in the paternity of some class of the domestic ducks as well as the mallard. The black duck breeds here on the banks of remote streams, small creeks, and lakes. The female lays from twelve to fourteen eggs, and may be seen with a dozen young ones following her early in the month of July. Of this number, probably about six or eight, frequently fewer, arrive at maturity, owing to their exposure to the attacks of the fox, mink, weasel, and the whole family of larger hawks and falcons. When they are first able to take wing the parent birds and the young fly close together, but after having been shot at a few times they separate, and afterwards fly singly or in pairs. Late in the fall, when preparing to migrate, they, however, assemble in large flocks. The best sport in the way of black duck shooting is during the evening flights. In the dusk of the evening they become perfectly fearless of man, and come swooping down on the dead wing into the marsh or rice field within ten or fifteen feet of their enemy. If black ducks are hatched by a domestic hen, they are easily tamed, and become much more docile and much more easily handled than the ordinary tame duck. I once had a beautiful pair which were perfectly tame. I had taught them to come when I whistled. On many an occasion, when out of sight, some hundreds of yards off, in answer to my whistle, I have seen

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them sailing home over the tops of cedars in the greatest haste. With the exception of my pet otter, "Pontiac," the two ducks in question were the most affectionate and interesting pets I have ever had in my possession.

In point of standing and respectability, the mallard comes next to the black duck. The mallard *(Anas boschas)* is the original parent stock of the common domesticated duck. The drake of the latter species—wanting only the fineness of outline—bears a complete resemblance to the wild drake or mallard. The females of the wild species are of a uniform grey colour like the plumage of the tame breed. This fine duck is of about the same size and weight as the black duck. It, like the latter, is so generally known as scarcely to require further description. The flesh of the mallard is scarcely equal to that of the black duck, being somewhat coarser in quality. The mallard is a somewhat rare visitant in the Ottawa region. It is quite plentiful, however, in the far western parts of Canada, particularly in the preserved shooting grounds at the "St. Clair Flats." Sir John Richardson says:—"The common wild duck is found in every fresh water river and lake of the United States in winter, but seldom frequents the sea shore or salt marshes. Their summer residence is the north, the great nursery of this numerous genus. Instances have been known of some solitary pairs breeding here in autumn. In England these instances are more common. The nest is usually placed in the most solitary recess of the marsh or bog, amidst coarse grass, reeds, and rushes, and generally contains from twelve to sixteen eggs of a dull greenish white. The young are led about by the mother in the same manner as are those of the tame duck, but with a superior caution, a cunning and watchful vigilance peculiar to her situation. The male attaches himself to one female, as among other birds in their native state, and is the guardian and protector of her and her feeble brood. The mallard is numerous in the rice fields of the Southern States during winter, many of the fields being covered with a few inches of water, and the scattered grains of the former harvest lying in abundance, the ducks swim about and feed at pleasure." The wood duck *(Aix sponsa)*, is smaller by more than one-third than either the black duck or the mallard. The male is one of the most beautifully marked birds of the whole duck genus. In a preserved state it is

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generally found amongst the ornamental ornithological curiosities of museums. The wood duck arrives here early in April and remains until the end of October. Solitary birds may, however, be seen at a later period. It breeds in this country, building its nest in a hollow tree, to which the same birds, if unmolested, will return year after year. It derives its name of wood duck from this peculiarity, as well as from its habit of perching on the branches of trees and on the tops of rampikes. This singularity in the character of an aquatic bird is noticeable during the breeding season more than at any other time. These ducks are seldom, perhaps never, seen on trees in the fall of the year. The female boasts of none of the elegant plumage of the male, being simply of a dark brown colour on the back and wings, with white breast and belly in adult birds. She has, however, all the tongue to herself. Her tongue is the loudest and most musical of any duck known in Canada. In their habits, wood ducks are very similar to black ducks, being frequently found feeding together. In common with all non-diving ducks, they feed close to the shore in shallow water. I have often seen them on land, acres away from the water, in search of beech nuts and acorns, of both of which they are exceedingly fond. They are not so wary and difficult to approach as the black duck or the golden eye, although they are constantly on the lookout for danger. In common with all non-divers, the wood duck is fond of wild rice. In the evenings, in September especially, large numbers of them resort to the rice fields to be found in different places on the Ottawa River, when they are shot, and shot at, from boats, canoes, and muskrat houses as they arrive. The flight begins between sundown and dark, and flock follows flock in rapid succession, occasionally until after midnight. Were it not—and very properly so—in direct contravention of the Game Act, excellent sport might be had on a clear moonlight night, as they fly in, perfectly regardless of the noise made by the gun. Having fed throughout the night, the birds leave the rice before daylight next morning to fly to their usual places of resort for miles around; those only remaining about the place which had been hatched in the vicinity. Although the wood duck never dives when feeding, it is, nevertheless, a cunning and active diver when wounded. It is a fact also well known to sportsmen acquainted with the habits of ducks, that this bird,

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as well as some others, when mortally wounded, will, sometimes, dive and seize a weed to which it may be found—providing the water is not too deep—firmly clinging after death. The female wood duck, shortly after hatching out her young, conveys them from her high nest to the ground or water, as the case may be, by seizing them with her bill. When surprised and alarmed the young ones hide and remain in concealment until the danger is over, which they are made aware of by the voice of the parent bird calling them together. In the moulting season the male bird loses his fine variegated tuft; but he may still be distinguished from the female by the white and rose colours of his bill, as well as by the well defined outlines of the rich and brilliant hues peculiar to his head and sides. When caught young, this beautiful duck is easily tamed, and becomes quite familiar with the person by whom it is usually fed. I kept one that I had slightly wounded for two years, during all of which time it remained in all the gorgeous beauty of full plumage. It subsisted chiefly upon Indian corn, of which it seemed very fond. The habitat of the wood duck may be said to cover all parts of Canada and the United States. No one of the wild fowl family is better known to sportsmen. In addition to the great beauty of its plumage, its flesh is fully equal in flavour and delicacy to to that of the black duck or the mallard. The wood duck flies, particularly down the wind, with great swiftness, and the sportsman, who, under such conditions can knock over one with each barrel, going at the rate of eighty miles an hour, has no reason to complain of the quality of his gun, or the straightness of the eye that looks over the barrels. The specific name of the wood duck is *sponsa*, a bride. Why given it is hard to tell, unless its gorgeous plumage may be considered symbolical of the spousal array of some fair one decked out in the glory of her wedding garments. Next in order comes the green winged teal, so called from the large beauty spot on each wing. The green winged teal (*Querquedula carolinensis*) makes its appearance in this part of Canada in small numbers, early in the month of April. The male bird is beautifully marked, the head being of a glossy reddish chestnut, with a broad band of silky green running from the eye backwards to the nape, edged above and below by a fine line of brownish white. The female is destitute of this ornamental plumage, being simply a little

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grey bird with dark round spots on the breast. Both male and female have a large green speculum on the wings, from which the name is derived. The flight of these birds is exceedingly rapid and irregular, and their mode of alighting sudden and abrupt. They are very easily approached and do not exhibit so much alarm at the proximity of man as many of the larger species. Their note is a hoarse quack, which, however, is seldom heard except when they are suddenly alarmed and put to flight. It is very doubtful whether they breed in this part of Canada. It is certain, however, as far as my experience can determine, that young broods are never seen here. The green winged teal resorts chiefly to inundated lands in the spring, and to shallows near shores and adjacent to rapids in the autumn. They do not dive when feeding; but when wounded are almost equal to the loon or the golden eye under water. The blue winged teal (*Querquedula discors*) is seldom seen in this neighbourhood until late in the season. It arrives about the 15th September, and then, as a rule, only in limited numbers. An old male bird of this species is nearly as large as a wood duck, although much shorter in the body and neck. They are commonly seen in flocks of from eight to twelve feeding on low marshy ground and along the shores of streams. In exceptional seasons, I have seen flocks of blue winged teal containing upwards of two hundred. This occurred on the River Goodwood one afternoon late in September, about fourteen years ago. They did not all get away; for, during part of the day, I killed fifty ducks, and paddled my own canoe in a stiff breeze into the bargain. The flight of the blue winged teal is very rapid, like that of the pigeon; and when about to alight they drop down suddenly like a snipe or a woodcock. As a rare delicacy the flesh of this bird is unsurpassed, if it is equalled, by any bird of the duck family. In habit, the blue winged teal is identical with the black duck, the wood duck, and the green winged variety, in diving only in sport and when wounded. These birds may frequently be seen in company with the black ducks. I remember having on one occasion knocked down two black ducks and three blue winged teal at one discharge. On several other occasions I have killed a mallard, a black duck, and a wood duck at a single shot. If not much disturbed, the blue winged teal is comparatively easy of approach; consequently it falls an easy prey to the gun of the sports-

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man. The male and female differ but little in plumage—both being of a light grey colour above, and mottled with dark specks underneath. The wings are marked with a large patch of light blue, from which feature it gets its name. In shape and general contour it is precisely similar to the black duck, and in habits much the same, both delighting to feed along muddy shores. These birds are very numerous in Manitoba and the North-West, where very few of our black ducks are to be met, although mallards are extremely abundant. Like the green wing the blue wing has a harsh discordant voice, hence its latin designation, *discors*. Next to the eider duck perhaps the blue winged teal may be said to fly with greater velocity than any other. Going down the wind, it sometimes puzzles the quickest hand to get the muzzle in the right place. I have seen one of these birds killed dead—and that is a sporting phrase—fall and strike the water twenty yards beyond a perpendicular descent. Like the black duck, the wood duck, the mallard, and the green winged, the blue wing is fond of sitting on logs or on shore in some secluded spot in the heat of the day, at which time it is much more difficult to approach than when found feeding or listlessly sitting on the water. Next in order, or perhaps among the first that ought to have been mentioned in the list of non-divers, is the pintail (*Dafila acuta*), the most elegantly formed and most graceful of all ducks. The male pintail is a beautiful bird. Its colour is a variegated grey on the back and sides, belly white, head a rich brown with a white line on each side, commencing at the back of the neck and widening with a graceful curve into the white plumage of the breast. The pure whiteness of the belly terminates against a black velvety bar underneath the root of the tail. The beauty spot on the wing is black, striped with fine lines of white formed of loose crest-like feathers. The female is simply a sober grey colour, of a much more beautiful hue, however, than that of the female mallard. These elegant birds are rare visitors here, being only occasionally seen in spring during high floods, and in the fall. Their habits are similar to what I have already mentioned as the characteristics of the non-diving varieties. I may mention here that, three years ago, I shot a magnificent specimen of the male pintail, at the mouth of Brigham's Creek, which I have had stuffed and set up, and which, for style and beauty, it would be difficult to surpass. The

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redhead (*Fuligula ferina americana*) is a rare visitant on the Ottawa in the spring. They are, however, to be found in considerable numbers about Black Bay, near the mouth of the North Nation River, in the fall. The body of the male bird is of a bluish-grey colour, the head red, the breast and the lower part of the neck black. The plumage of the female—as is generally the case amongst birds—is much less attractive than that of the male. The red head and the silky black band around the breast are wanting in the female. The redhead is a large heavy duck, and is considered excellent for the table. Large flocks of these birds frequent Chesapeake Bay, in the United States, where they watch the canvas-backs when the latter are diving for the wild celery. After a long dive, the instant the canvas-backs emerge, the redheads rush at them and rob them of the fruits of their labour. The canvas-back eats the root only of the *valisneria*, while his plunderer—pirate as he is—devours both the roots and the leaves of the plant. Like the canvas-back, the redhead will eat little of anything else while it can get the wild celery, which causes the flesh of the latter almost to rival in delicacy of flavour the former celebrated bird. The sheldrake, goosander or water-pheasant (*Mergus merganser*) is the largest and heaviest of the mergansers to be met with here. The male of the largest size frequently reaches the weight of five pounds. In spring, when the plumage of all wild ducks is most beautiful, the male of this species is black on the back, breast and belly a rich cream colour, head and neck a dark glossy green. The bill is long, narrow, strongly serrated, with a crimson line running from the base to the point on each side. The female is much less gorgeously arrayed. She is of an uniform light slate colour on the back, white belly, and rusty coloured red head, slightly tufted. In the fall the male bird appears in the less attractive livery of his mate. These birds make their appearance here early in the spring in the first open water, and remain until the ice warns them to depart. Many, however, remain all winter, and may be seen with the golden-eyes in rapids and at the foot of waterfalls. Next to the loon, or the red-throated diver, the sheldrake takes the front rank in capacity for speed and endurance under water. The sheldrake subsists upon fish, consequently its flesh has a fishy flavour, which requires some knowledge of cookery to overcome. I have seen twelve

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or fourteen of these birds diving in a sort of semicircle towards a small bay or indentation of the shore. As they approached they made quite a noise by fluttering while on the surface of the water. They were driving before them a shoal of small fish. When they got the fish crowded together in the little inlet, they plunged down amongst them, and the slaughter began. I shot one of the largest of the birds; and when brought to land by my dog, I noticed a sucker about six inches long in his throat; I took him by the legs and gave him a smart snapping shake, and out came the sucker accompanied by five or six minnows about four inches in length. I continued the shaking process, and finally managed to bring to light no fewer than sixty-eight of the smaller fishes in addition to the sucker. Mr. J. T. Coleman, the city taxidermist, has informed me that he once captured a sheldrake which appeared to be in a dying condition, and found that the bird had swallowed a large mudpout, the lateral horns of which had pierced the skin on each side of the gullet and disabled him. I kept a sheldrake an entire summer, and after he had devoured, as closely as I could calculate, nearly 4,000 small fish, chub, rock bass, black bass, perch and sunfish, he dived out of existence in the attempt to bolt a rock bass as large as my hand. These facts go to illustrate the extreme voracity of this king of the mergansers. The merganser is a fearless bird, seldom turning out of his line of flight to avoid man, and, compared with other ducks, somewhat slow on the wing. The sheldrakes breed on the tributaries of the Ottawa River in considerable numbers. Like wood ducks they build their nests in hollow trees, although they are never seen perched on trees like the former. The young broods may be seen following the mother in the month of June. When pursued they dive and make for land, where they hide in the brush; whence they emerge again at the call of the parent bird. In contradistinction to the habits of the non-divers, the mergansers, excepting under the circumstances I have mentioned, never take refuge on land. The young sheldrakes, when well grown into the flapper transition, will skim over the top of the water at the rate of twelve miles an hour, rapids and chutes being but trifling obstacles in their way. The red-breasted merganser *(Mergus serrator)* is a very rare stranger on the Ottawa or any of its tributaries. It is a much smaller bird than the sheldrake. The male bird is black on the back and wings, with a red breast and

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part of the neck and head black, the latter being crowned with a jet black crest of fine hair-like feathers. The female is of a brownish dark slate colour on the back, belly white, head light brown, and is much smaller than the male. The food, habits, etc., of this bird are identical with those of the sheldrake. The hooded merganser *(Mergus cucullatus)* makes its appearance here about the first of April, or as soon as it can find open water along the shores to feed in. This bird is considerably less in size than the red-breasted variety. The male bird is one of the most beautiful of ducks. The back is black, sides elegantly variegated, belly white, neck and head jet black. The head is adorned with a stately crest of white, semi-circular in form, bordered by a well defined band of black. This magnificent crest can be raised or lowered at pleasure. The female is more plainly attired, being merely of a dark brown on the back, with white belly and a dusky coloured crest of hair-like feathers. Unlike the other mergansers this bird has a yellow eye, and the wing speculum is white. The hooded, or crested merganser as I should prefer calling this beautiful bird, is an expert diver, but instead of fish it feeds on insects, larvæ and, probably, wild rice. Its flesh is not fishy in taste, still it is not equal to that of the better classes of the non-divers. These birds breed here. When not feeding they swim close together, and fly also in a compact manner. Their favourite feeding places are along shores under overhanging bushes. The golden-eye *(Clangula glacium)*, deriving its name from the loud whistling sound made by its wings when flying, belongs to the sub-family *fuligulinæ* or sea ducks. The golden-eye is widely distributed over every quarter of the globe. It is well known in the Arctic, as well as the Antarctic Ocean. The clear whistle of its wings can be heard by the Icelander as well as by the Patagonian—by the borderer of Cape Clear and the climber of the cliffs of the Orkneys—by the Esquimaux of Hudson's Bay and the dweller on the shores of the Gulf of Mexico—by the British Columbian and the New Zealander. Wherever open water along a coast can be found, the golden-eye, at some season of the year, makes its home. No aquatic bird is more generally known to sportsmen and ornithologists than the golden-eye. The golden-eye is a bold and strong diver, feeding frequently in water twenty feet deep. Many of them remain in this part of Canada all winter, frequenting rapid open

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water wherever they can find it. They feed on aquatic insects, larvæ and wild rice; and doubtless make considerable havoc amongst the spawn of fish. Although much shorter in the body, specimens may sometimes be found almost as heavy as a black duck. The flesh is destitute of the fishy flavour peculiar to the sheldrakes; still it is much inferior in this respect to any of the non-divers. These birds are exceedingly wary and hard to get at. The run-at-the-dive dodge is the best mode to approach them. I am not aware of their breeding here. The male golden-eye—only to be found in full plumage in the spring—is beautifully white underneath, with black wings and white beauty spot. The head is dark green with a small white spot on each side at the root of the bill. The female is bluish black on the back, white belly and head of dark dusky brown. The buffle-head *(Clangula albeola)* is the smallest of the divers. The male is elegantly marked. The belly is dusky white, quite silky in appearance. The wings and back are black. The head is purplish green, with a large white spot on each side. The legs and feet are of a delicate flesh-colour. The female is simply black and white with small white spots on the head. These elegant little ducks are excellent eating. They are so fat that in the United States they are called "butter balls." The buffle-head is a good diver. Like the bluebill, it prefers broad open water to creeks or small streams. The American widgeon *(Mareca americana)* is a handsome bird of the non-diving variety. It is slightly larger than the wood duck. The male bird has elegant plumage of a creamy red colour on the sides and front of the breast. The belly is white, and from a white spot on the top of the head it gets the name of "baldpate." The female is grey on the back, sides and breast of a reddish hue, and belly white. They are rare here in spring, and not at all numerous in the fall. I saw a very fine specimen which was shot by Mr. Whitcher at Lochaber Bay last fall. The flesh is highly esteemed. The greater bluebill *(Fuligula marila)* and the lesser bluebill *(Fuligula affinis)* are both to be met with in considerable numbers on the Ottawa in the fall, although very few of either kind are to be seen in that river or its tributaries in the spring. Both varieties are short and thick-bodied, white bellied in part, dark brown on the back and breast. They may easily be distinguished by the blue colour of their bills. They are expert divers, and feed on

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the *valisneria*, when they can get it. They are also very fond of the larvæ of the dragon-fly, to be found in great abundance at the bottom of streams near shore. The bluebills, like the canvas-backs, are only superior to the better classes of the non-divers when they can obtain the wild celery. They are also fond of wild rice, amongst the stalks of which they may be seen constantly diving late in the fall. The "ca-ca-wee" *(Harelda glacialis)* or "old wife," is a diver which comes from the north in the spring, passing down the Ottawa when the water is at its greatest height, resting here and there for a day, and following the flood down to the Gulf, or perhaps to the open sea. This bird gets its strange name from the notes of its voice. Its cackling may be heard quite a distance off. I have seen them frequently, but have never had an opportunity of examining a specimen. There are other ducks which occasionally visit the Ottawa river, the habits of which I have not yet had an opportunity to observe.

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REPORT OF THE GEOLOGICAL AND MINERALOGICAL BRANCH FOR THE SEASON OF 1882.

To the Council of the Ottawa Field Naturalists' Club :

The leaders of the Geological Branch of the Club beg to report that although no regular sub-excursions of the Club in this branch were held, still small working parties made constant investigations into the numerous palaeozoic exposures in the neighbouring districts. Notes on the most interesting sections and measures were taken, which, when the long needed accurate topographical map of the district is prepared, may prove of no little value in determining the relative ages and exact distribution of the various formations met. The following brief notes of observations made are now submitted as likely to prove of more immediate interest :

THE CHAZY FORMATION.—I. Quite an extensive patch of this formation was examined at the Club's second excursion to the Des Chênes Rapids, three miles below Aylmer, P.Q. These measures consist of

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light yellowish-grey sandstones, underlaid by dark bluish green arenaceous shales of a rather brittle nature. The rapids here doubtless owe their origin to these softer shales, which have been denuded and washed down the river. A few fossils were found in a stratum of rock which was ferruginous. The beds are almost horizontal, dipping very slightly to the west, and extend quite a distance west, south and east of this exposure, being well exposed at Aylmer and Britannia, as well as at Skead's Mill, where there is a quarry of building stone from which many of the finest edifices in Ottawa have been partially or wholly built.

II. Another interesting exposure of this formation, doubtless connected with that just described, occurs on the south-western shore of McKay's Lake, New Edinburgh, the strata here being but little superior stratigraphically to those at Des Chênes. This is brought to sight by an extensive fault running in an easterly direction across the measures of the Cambro-Silurian formations here, and referred to in the Geology of Canada, 1863, a downthrow on the north side of the fault being clearly shown. Altogether, the beds form a thickness of some 20 feet, and appear quite destitute of fossils; the upper measures consist of a very brittle series of greenish-grey argillaceous shales which cleave at all angles and disintegrate to some extent. This exposure is part of one of two anticlinals, the other being at Hog's Back, in Nepean, Ont., while in the synclinal basin between them are comprised the Black River, Trenton and Utica formations, together with the Pliocene and drift deposits.

III. The summit of the anticlinal at Hog's Back, Nepean, has been denuded and broken, a fault of several feet—again a downthrow on the north-eastern side of the fault—occupying the place where the rocks were rent. Here the sandstones predominate, and but very few shales occur. The hard quartzose beds pass from areno-argillaceous shales to calcareous sandstones, whilst the latter are immediately overlaid by limestones holding numerous fossil organisms. A band of the most argillaceous sandy beds yielded great numbers of the typical species *Lingula Belli*, (Billings), also an abundance of a lamellibranchiate mollusca, which may prove very interesting to palaeontologists, as

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these bivalves are exceedingly rare throughout this formaton. In last year's report this exposure was erroneously referred to the calciferous formation.

THE TRENTON FORMATION.—A fine section of the lower measures of this formation was observed and paced. It was some sixteen hundred feet in length, situated on the western extension of the Canadian Pacific Railway, a short distance from the Union Station, where a denuded anticlinal is exhibited. The dips in different parts of the section were ascertained and noted, as also the strike and the fossils observed. The dips were found to vary from 8° to 48° on the eastern side of the section.

THE UTICA FORMATION.—On the right bank of the Rideau River, opposite the Rifle Range, an exposure of this formation, worthy of note on account of its lithological character, was observed. Besides the ordinary bituminous shales there occur, interstratified in a section some 12 feet in thickness, ten or more bands of impure limestone, in some parts assuming a nodular character, in others very compact, varying from 2 or 3 to 10 inches in thickness. These hold a large number of fossils, as a rule very different from those in the overlying and underlying shales. Whilst the shales hold numerous specimens of *Asaphus Canadensis* (Chapman), associated with *Triarthrus Becki* (Green) and orthids, the bands of limestone teem with *Conularia Trentonensis*, *Zygospira Headi ?* (Bill.), *Calymene senaria* (Conrad), and other forms of life. It was in one of these bands of impure limestone, or one belonging to this series that *Siphonotreta Scotica* (Davidson), a prettily fringed Brachiopod, was found by Mr. J. W. H. Watts, R.C.A., its occurrence for the first time on this continent having but recently been made known to science by Mr. J. F. Whiteaves in a paper read before the American Association for the Advancement of Science in August 1882.

The whole respectfully submitted,

(Signed) WM. P. ANDERSON,
H. M. AMI,
H. WATTERS.

19th January, 1883.

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REPORT OF THE PALÆONTOLOGICAL BRANCH FOR THE SEASON OF 1882.

To the Council of the Ottawa Field Naturalists' Club :

The first excursion of the Club last season to the Laurentian Mountains at Chelsea of course afforded no opportunities for collecting fossils. At the DesChênes Rapids, where the second excursion was held, the sandstones of the Chazy formation proved very unfossiliferous, but by careful search Mr. H. M. Ami detected some specimens of *Orthis imperator*, Billings, and of the characteristic *Rhynchonella plena*, Hall.

The visit to Brigham's quarries, at Hull, on the 21st October, was made too late in the day, and too late in the season, to permit of full justice being done to this long known and favorite locality for collectors. These quarries are remarkable for the number and variety of the fossils found in them, on the weathered surfaces of slabs of Trenton limestone, and are specially rich in crinoids and monticuliporids. Stems of *Glyptocrinus* more than eight feet in length were observed in one part of the quarry, and fine examples of *Glyptocrinus ramulosus*, Billings, showing the heads and pinnulæ in a fine state of preservation, were also collected. Among other choice specimens obtained by members of the Club was a slab, showing a good example of the head and column of *Dendrocrinus acutidactylus*, Billings, surrounded by young *Glyptocrini*, both in an excellent state of preservation. The following is a list of the species collected on this particular occasion :

PROTOZOA. Stromatocerium rugosum, Hall.

CRINOIDEA. Glyptocrinus ramulosus, Billings, and G. decadactylus, Hall; Dendrocrinus acutidactylus, Billings; Heterocrinus subcrassus, Meek & Worthen.

POLYZOA. Arthoclema pulchellum, Billings ; Stictopora acuta, Hall, and Ptilodictya falciformis, Nicholson ; Prasopora Selwynii, Nicholson ; Monotrypella Trentonensis, Nicholson.

BRACHIOPODA. Rhynchonella capax, Conrad, var. increbescens, Hall, and R. recurvirostra, Hall; Orthis testudinaria, Dalman; Strophomena alternata, Conrad; Streptorhynchus filitextus, Hall ; Leptæna sericea, Sowerby.

LAMELLIBRANCHIATA. Ctenodonta nasuta, Hall.

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PTEROPODA.	Conularia Trentonensis, Hall.
GASTEROPODA.	Murchisonia gracilis, Hall.
CEPHALOPODA.	Endoceras proteiforme, Hall.
ANNELIDA.	Serpulites dissolutus, Billings.
CRUSTACEA.	Encrinurus vigilans, Hall.

Last summer Messrs. W. R. Billings and H. M. Ami paid special attention to collecting the Monticuliporidæ of the Black River and Trenton limestones of the neighborhood of Ottawa, and succeeded in finding six species that had not previously been recorded as occurring in Canada, and four that are new to science.

The six new to Canada are as follows :

Ptilodictya pavonia, D'Orbigny.
Ptilodictya maculata, Ulrich.
Stictopora paupera, Ulrich.
Monticulipora parasitica, Ulrich.
Amplexopora discoidea, Nicholson (Sp.)
Heterotrypa solitaria, Ulrich.

The four new to science have recently been described by Mr. A. H. Foord, in one of the publications of the "Geological and Natural History Survey of Canada," as *Monticulipora Billingsi, Prasopora oculata, Batostoma Ottawaense and Spatiopora areolota.*

During the season of 1882, also, Mr. W. R. Billings has made the following additions to the Fauna of the Trenton limestone near Ottawa City.

CÆLENTERATA.	Palæophyllum divaricans, Nicholson.
CRINOIDEA.	Glyptocrinus decadactylus, Hall.
	Glyptocrinus parvus, Hall.
	Heterocrinus subcrassus, Meek & Worthen.
ANNELIDA.	Conchicholites flexuosus, Hall.

From the Chazy formation at the Hog's Back, Messrs. Billings and Ami have obtained an interesting series of fossils, but these specimens have not yet been studied nor the species identified.

Mr. E. T. W. Sowter reports the discovery of considerable areas of Black River limestone, containing well preserved and characteristic fossils, between Aylmer and the mountains to the north, also to the N. W. of Aylmer, in a tract of country previously laid down on the maps as exclusively occupied by the Chazy formation.

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Finally, specimens of a rare spinose brachiopod, belonging to the genus *Siphonotreta* of De Verneuil (a genus not known to occur in North America), and referable to a Scotch species, the *S. Scotica* of Davidson, have been collected by Mr. J. W. H. Watts, in the Utica Slate formation near Cumming's Bridge. A paper descriptive of these specimens was read before the Geological Section of the American Association for the Advancement of Science, at its last meeting in Montreal.

J. F. WHITEAVES.

W. R. BILLINGS.

16th February, 1883.

REPORT OF THE BOTANICAL BRANCH FOR THE SEASON OF 1882.

To the Council of the Ottawa Field Naturalist's Club :

During the season just concluded, the Botanic section has continued the system inaugurated during the previous year : imparting information, bringing together those interested in the work, forming sub-excursions and working parties, being the chief duties your committee has kept in view.

The work in this branch has progressed steadily. Our knowledge of the 'Flora' of this district has been increased by the discovery of new specimens and finding new localities for old ones, but none of the systematic observations commenced are sufficiently complete to add to this report.

A pleasing feature has been the frequency with which information has been sought by members, not only by those who are actually engaged in collecting and preserving specimens, but also by those whose duties will not permit them to devote much time to the study of natural history. Several additions have been made to the working members, many being beginners. Professor Macoun, hitherto one of our corresponding members, has removed to this city and entered into active membership. His botanical knowledge and extensive collection will be welcomed by this branch, while his well-known energy cannot but add

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to the success of the Club. The presence in this city, for some weeks, of Professor Fowler, of Queen's University, Kingston, was a source of much pleasure and profit to our botanists.

The prizes offered by the President have not received the attention they deserved. For the best collection of local plants, only one of the many beginners has persevered in preparing a collection for competition; but this one, numbering 257 specimens, has been so correctly prepared that it is well worthy of the prize, and we have much pleasure in recommending Mr. T. J. MacLaughlin for that honor. For the greatest number of additions to our published list we are of opinion that no prize should be awarded. A few have competed, but the President—although not a competitor—has added more than five times as many as all others.

The number of new plants this year is 24, a very satisfactory result when we remember that this is the fourth year since the "Flora Otawaensis" was published. In the list this year, you will find the name of the discoverer added to each plant, so that anyone desiring duplicates may know to whom he should apply. For the first time, we notice with pleasure the name of a lady who has added to our list of new plants; it is to be hoped that during the coming year others will follow this example and some of them succeed in carrying off prizes.

It is greatly regretted that the Club excursions have not been more numerous, as this is the most favorable means we possess of bringing together workers and non-workers, and, possibly, of awakening some dormant talent for natural history.

Sub-excursions were held frequently throughout the summer; regular morning expeditions were made, and individual efforts have been prosecuted with so much zeal, that there is no available locality that has not yielded something new.

At the excursion to Des Chênes Rapids *Carya alba* and *Potentilla Canadensis* were added to our list. The former—which produces the sweet hickory nut—is of interest, as this is the most northerly and easterly point where it is recorded as growing. On the sandy islands above Aylmer two grasses were discovered—*Andropogon furcatus* and *Sorghum nutans*, also near the same spot *Lithospermum hirtum*. In the ravine near Old Chelsea the walking-fern, *Camp-*

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tosorus rhizophyllus, was found; hitherto this had only been obtained from the rocky ridges on the south bank of the Ottawa, below the city. In Hull, near Lake Flora, *Muhlenbergia Mexicana* and *Rhus aromatica* were discovered. Near the mouth of the Gatineau River *Iris tenax* was gathered. This is a very rare plant, being a native of the Southern States; it has never been previously recorded as growing in Canada, and Gray does not mention it as being found in the northern United States. The neighborhood of Lake Wyndiago has contributed *Melampyrum Americanum*. In the spring *Ranunculus Cymbalaria* was found at Thurso growing in low clay meadows in great profusion. This is a curiosity, as its natural habitat is along the sea coast and in the neighborhood of salt springs. A special study of the maritime plants which occur in this locality would form an interesting subject for some of our members. Several have already been observed; some of you will remember the *Triglochin maritimum* var. *elatum* found in the Mer Bleue on one of our excursions. Near Hemlock Lake two rare ferns were discovered, *Pellæa gracilis* and *Ophioglossum vulgatum*; here, also, *Daphne mezereum* was seen growing. This last is not a native of America, but two bushes were found by different members of the club growing wild, one in the woods behind Rideau Hall, and the other in fine fruit among rocks by Hemlock Lake. Some years ago two bushes were found on the top of Mount Royal, Montreal, far from any residence or thoroughfare. The bushes were noticed upon more than one occasion, and to judge from their size and their rootstalks were of great age. At Billing's Bridge *Viola pubescens* var. *scabriuscula* and *Celtis occidentalis* were observed, of the latter only three or four trees grow here, and we are informed by Professor Macoun that with the exception of a grove of six at Belleville, none others are known east of Hamilton. The occurrence of such solitary specimens of full grown trees introduces a subject for speculation. Are they chance introductions, or are they remnants of a previous flora? Dow's swamp has proved almost an inexhaustible hunting ground. Here was found that great rarity the Ram's-head orchid *Cypripedium Arietinum* which was found in great profusion within a limited area. In the same place two other rare orchids were found in large numbers *Habenaria rotundifolia* and *Microstylis monophyllos*. It is curious that this last species

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should have been found so plentifully this year, while of *M. ophioglossoides*, which in previous years had been obtained in large numbers, only one specimen was found. This habit of appearing in large numbers and then disappearing is peculiar to some families especially Orchids and Aquatics. Good collections were also made of *Aspidium cristatum var. Clintonianum.* In the Rideau Canal Mr. Fletcher found *Lemna minor* flowering profusely, the first date on which it was noticed was the 5th July. This has not previously been recorded as having been found in flower in Canada. At the same time the form of *Potamogeton Vaseyi* with emersed leaves was found in fruit; some good specimens were obtained, but a large proportion was found to be infested by a parasitic fungus. A few poor specimens taken from dried plants were sent to Professor Farlow, of Harvard University, who replied concerning it: "The specimens are very interesting. The fungus is something "which I have never seen before, and which, as far as I can ascertain, is "as yet undescribed. It is probable that it belongs to the *Ustilagineæ* "but it is possible that it belongs to a new genus." The study of these parasitic fungi is at the best very difficult, and can only be done satisfactorily from fresh specimens and in larger quantities than were sent to Professor Farlow. A peculiar form of *Potamogeton pusillus* with small emersed leaves was noticed, this form the Rev. T. Morong pronounces as very similar to the Sicilian variety of *P. pusillus* called *panormitanus Biv.* Three or four expeditions were made to the Mer Bleue with good results, large collections being made of *Eriophorum vaginatum, Carex pauciflora, Carex limosa* and *Carex exilis.* The last named has not before been noticed in Canada, it is a species common along the base of the White Mountains and very probably it will be found between this locality and its native habitat.

In conclusion, we appeal to the members generally to make more notes for the benefit of the committee. The earliest date that leaves were noticed on certain trees, or the first and last appearance of any of our wild flowers, may appear of little value, yet, when added to the observations of others, may prove a very useful contribution to science.

R. B. WHYTE.
BEAUMONT SMALL, M.D. } Leaders.

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APPENDIX.

Flora Ottawaensis ; Additions to Previously Published Lists.

Ranunculaceæ.		
Ranunculus Cymbalaria, Pursh (leaves).	Mr. Fletcher,	May 24
Cruciferæ.		
Cardamine rotundifolia, Michx.	"	" 17
Violaceæ.		
Viola pubescens, v. scabriuscula, T. & G.	"	" 20
Anacardiaceæ.		
Rhus aromatica, Ait.	Mr. H. M. Ami.	June 2
Rosaceæ.		
Potentilla Canadensis, L.	Mr. Fletcher,	Sept. 2
Rubiaceæ.		
Sherardia arvensis, L.	Mr. H. M. Ami.	July 24
Compositæ.		
Ambrosia trifida, L.	Mr. Fletcher,	Aug. 25
Helenium autumnale, L.	Mr. H. M. Ami,	Sept. 25
Scrophulariaceæ.		
Melampyrum Americanum, Michx.	Dr. Small.	July 22
Borraginaceæ,		
Lithospermum hirtum, Lehm.	Mrs. Chamberlin.	Aug. 20
Polygonaceæ.		
Rumex Britannica, L.	Mr. Fletcher.	Sept. 15
Thymelaceæ.		
Daphne Mezereum, L.	Mrs. Chamberlin,	May 15
Urticaceæ.		
Celtis occidentalis, L.	Mr. Fletcher,	" 15
Juglandaceæ.		
Carya alba, Nutt.	"	Sept. 2
Orchidaceæ.		
Cypripedium arietinum, R. Br.	"	June 12
Iridaceæ.		
Iris tenax.	"	July 21
Cyperaceæ.		
Carex exilis, Dew,	"	June 17
" aperta, Boot.	"	July 30
Gramineæ.		
Muhlenbergia Mexicana, Trin.	"	Aug. 20
Andropogon furcatus, Muhl.	"	Sept. 28
Sorghum nutans, Gray.	"	Sept. 28
Filices.		
Pellæa gracilis, Hook.	Mr. R. B. Whyte.	July 1
Aspidium cristatum, v. Clintonianum, Gray.	Mr. Fletcher,	July 31
Ophioglossum vulgatum, L.	"	July 15

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REPORT OF THE CONCHOLOGICAL BRANCH FOR THE SEASON OF 1882.

To the Council of the Ottawa Field-Naturalists' Club.

I regret exceedingly that circumstances have for the present caused the withdrawal of my colleague, Mr. Latchford, from active work in the Club, and although much the larger proportion of the work to be recorded was done by, or at the instigation of, that gentleman, the preparation of the report from this section falls to my lot.

During the past season several excursions have been organized, and a considerable amount of work accomplished. The number of interesting species noted, however, has been smaller than might have been expected; nevertheless good series have been collected of forms heretofore considered rare in this locality, such as *Unio pressus* which was found in considerable numbers by Mr. Latchford and Mr. Tyrrell in the Rideau River, by the Rifle Range. Some interesting varietal forms of *Goniobasis livescens*, Menke, have also been secured.

The same gentlemen made a very successful excursion to Meech's Lake, in the month of September, when, among other species, good collections of *Limnæa megasoma*, *Physa Lordi* and *Anodonta fragilis* were obtained.

The last named species was found to be badly infested with parasitic mites, one of which, found in the gills of the mollusc, and as yet undescribed, was remarkable for its extraordinary size, being of the dimensions of a large marrow-fat pea.

Some nice specimens of *Mesodon Sayii*, Binney, were found by Mr. Latchford near the Beaver Meadow in Hull, in November; and another beautiful shell, which has, for the present, been referred to *Succinea aurea*, Lea, was also discovered. It is possible, however, that it may only be the young of *S. ovalis*, Gould.

A large *Limax* resembling *L. agrestis*, Say, was likewise detected in a garden inside the city limits; but its identity is not certain.

It is right to mention that a collection of specimens. which has been sent to specialists in the United States, has not yet been returned, and which, when received, will add some new species to our local list.

Owing to the height of the water in the Ottawa River, the past season has been a very unfavourable one for collecting *Unios*.

2nd February, 1883. PASCAL POIRIER.

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REPORT OF THE ENTOMOLOGICAL BRANCH FOR THE SEASON OF 1882.

To the Council of the Ottawa Field-Naturalists' Club.

As this Report is intended to be but a brief outline of the work of the Club during the year, it must necessarily deal with generalities rather than with the details which might be looked for as desirable in an ordinary entomological paper.

It is much regretted that the number of workers in this Branch has been but slightly augmented since the organization of the Club, and that in consequence the collections in the different orders progress but slowly, while some are almost totally neglected.

The season opened much later than in 1881 and quantities of snow and ice remained in the woods on 7th April, while even in May there was a snow-fall on the 2nd and several frosty nights during the early part of the month. Consequently there was no great abundance of insect-life until toward the middle of May, but from that time the season was a favourable one for collecting, and specimens were numerous to the end of October. Collections were made at each of the three Club Excursions, and sub-excursions also visited Thurso, the Mer Bleue, Chelsea, McKay's Bush, Templeton, Billings' Bridge, etc. The most important work, however, was done by individual members.

It is thought desirable to indicate the relative attention which the several orders have hitherto received, and they are therefore treated separately. Unfortunately the extensive collections made in this vicinity by the late Mr. Billings have been interspersed with numerous species received from other localities, and are therefore unavailable for the compilation of our lists; thus the whole ground has to be covered afresh.

Hymenoptera.—This order, containing our bees, wasps, ants, etc., offers perhaps more inducements to the student of insect life (not the mere collector of insects) than any other, and it is much to be deplored that so little is yet known of our species. We have no worker devoted to this order, and although a considerable number of species have been collected, and are available for study, but few have yet been named. The only group to which particular attention has been devoted is the Uroceridæ, or Horntails. Several species are found here destroying our

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trees, and some notes on them have been recently published in the Canadian Entomologist (Dec. 1882) to which members are referred for further particulars.

Of the Tenthredinidæ, or Saw-flies, some ten or more species are so far known. This is a very obnoxious group of insects and should therefore be carefully investigated. One very common species is *Nematus ventricosus*, the currant-worm, so troublesome to growers of gooseberries and currants. Three or four species are found upon the pines, and in 1881 some red-pines *(Pinus resinosa)* near Hull were very badly injured by a species of Lophyrus. Some of the smaller trees were found last summer to have died from the injuries of the preceding season, while others had all the lower limbs killed. The Ichneumonidæ —parasitic insects and good friends to agriculturists—are very numerous and of interesting habits and forms. As an instance of the way in which they destroy other insects, it may be mentioned that although the caterpillars of *V. antiopa* were abundant during the summer, but few butterflies developed, owing to the great number of pupæ infested with the little parasite called *Pteromalus vanessæ* ? From one chrysalid over 350 minute glittering four-winged flies were counted, while many more remained in it, so that it probably fed 450-500. This chrysalid was one of a brood, all of which were similarly affected, and at different times and places during the season the chrysalids were found almost universally destroyed. A closely allied species, *P. puparum* has been most useful in checking the increase of the obnoxious cabbage-butterfly.

Lepidoptera.—Butterflies and moths, the most beautiful, and in their larval stages among the most destructive, of the insect hosts, have, despite their charms, been sadly neglected. Only two members collected last season, and of these, one, we are sorry to say, has removed from the city, possibly not to return, and has taken with him his collections. This gentleman, Mr. A. W. Hanham, is an enthusiastic lepidopterist and made a large collection during May, June and July. He has kindly furnished us, by request, with a list of his butterflies and of about fifty species of moths, adding: "I have 80 varieties Noctuinæ and Geometrinæ unnamed, and about 90 sorts micro-lepidoptera. * * * I would like to be at the meeting of the Club. I hope the information which I enclose, scant though it is, will help you in your report." A

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comparison of Mr. Hanham's list of butterflies, containing thirty-nine species, with one published by the late Mr. Billings (Can. Ent. Vol. I) in 1868, and which contains the same number of species, shows that there are nine species in each which are not in the other, which with two additional species known in other collections will make a total of fifty species so far recorded from this locality. It was at first proposed to publish as an appendix a list of butterflies, but by deferring it for another year it will probably be made more complete. Among Mr. Hanham's butterflies is *Pieris rapæ*, the cabbage-butterfly, now the most common of all our species, but which has been introduced since the date of the older list. This fact shows the importance of publishing local lists, which are not only valuable as records of the species then known, but for comparison in after years by persons studying the changes which are ever taking place in fauna and flora. Among Mr. Hanham's butterflies was a Thecla (taken near Hull on 21st May) a drawing of which was sent to Mr. W. H. Edwards, who writes that it is probably *Thecla niphon*, a rare species, of which he has only taken two specimens. Specimens of *Eudryas grata*, the Beautiful Woodnymph, were received on July 10th, from Mr. Geo. Hay, with a statement that they were very numerous on his grape-vines. Lady Ritchie also sent a pair which were taken in the Chief Justice's garden. This moth was unusually abundant last season, but, although the larvæ feed upon the grape, we did not hear any complaints from fruit-growers of trouble with it, but it was reported as disfiguring the Virginia creeper in some places. The red-humped caterpillars of *Notodonta concinna* were reported on apple trees near the city. They are voracious feeders, stripping branches, and sometimes small trees, very rapidly, but are easily detected and destroyed and need not be much feared. The number of butterflies and moths already captured here indicates that this is a rich field for the lepidopterist, and when properly worked and sugared it will undoubtedly yield a rich and varied harvest.

DIPTERA.—This order of two-winged flies contains our most pugnacious and aggressive insects. They not only valiantly, and often successfully, defend their native glades and meadows, but also swarm forth to make war upon us in our houses. Yet so little is known about them that we are in doubt even as to the title or titles of our mosquitoes.

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Some 50 or 60 species of flies have been collected, but the majority are yet unnamed, while to arrive at a correct knowledge of their habits and metamorphoses will require a vast amount of study and of original investigation in the future. As an example of the curious forms often met with in this order may be mentioned the peculiar little Hammer-headed fly, *Sphyracephala brevicornis*, taken on Parliament Hill, 14th Oct., and in Stewarton on 9th Nov.

COLEOPTERA.—This order, always a favourite with entomologists, from the comparative ease with which its specimens can be collected and preserved, has had the most attention bestowed upon it. Over 800 species have been collected, but work hitherto has been chiefly confined to families found upon plants—especially such as are injurious thereto—and the numerous water and ground beetles are poorly represented in our collections. It will require much systematic collecting to arrive at a fair knowledge of our numerous species of *Carabidæ*, *Dytiscidæ*, etc.

Last season especial attention was given to our hickory and butternut trees. A grove of these trees near Hull was visited by Mr. Harrington at intervals throughout the season, and the trees were found to suffer much from insects of various orders. Among the beetles captured were *Dicerca lurida*, *Chrysobothris femorata*, *Anthaxia viridicornis*, *A. vividifrons*, *Agrilus egenus*, *Dorcheschema nigrum*, *Goes occulatus*, *Goes pulverulentus*, *Saperda discoidea*, *Gaurotes cyanipennis*, *Clytus erythocephalus*, *Leptostylus macula*, *Hyperplatys adspersus*, *Chariessa pilosa*, *Magdalis barbita*, *Pseudomus truncatus*, and *Acoptus suturalis*. Several of the species had not previously been taken by him, though they seemed to be very abundant, as, for instance, *Dorcheschema nigrum* and *Dicerca lurida*. The sumacs growing abundantly in and around this grove also yielded when in flower numerous specimens of some of the same species and of other Cerambycidæ, etc., the majority of which had probably been bred from the neighbouring trees.

The following are the dates of occurrence of a few species:—*Saperda candida*, Hull, 12th July, on Service-berry; *Saperda mutica*, Fairy Lake, 16th July, on willow; *Glycobius speciosus*, taken 20th July by M. Ami, (this is not common here; our maples apparently do not suffer much from it); *Pœcilinota cyanipes*, Hemlock Lake, 22nd July, on willow; *Desmocerus palliatus*, Lover's Walk and Rideau Hall, 20th-31st

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July, on elder, (an examination of the elders around the Lover's Walk later in the season showed them to be badly infested with the larvæ of this beetle and of some moth). The Locust-borer, *Cyllene robiniæ*, was very common in the city during September. The locust trees in the city suffer greatly from the ravages of this beetle; the wonder is that some which have been noticed can survive their injuries. Specimens of the beetle were received from several persons. Several specimens of *Pogonocherus penicellatus* were taken between 26th Sep. and 7th Oct. on fences, tree boxes, etc., in the city, and may possibly live in our maples. *Chalcophora virginiensis*, *C. Fortis* and *C. liberta* were taken on pines near Hull on 24th Sep. and 16th Oct. Among the last beetles taken were *Dicerca divaricata*, 30th Oct., and *Criocephalus agrestis*, 10th Nov. *Prasócuris varipes* was found in great numbers hybernating in crevices in the bark of an oak (*Quercus macrocarpus*) on 8th Dec.

HEMIPTERA.—This order contains the true bugs, many of which are beneficial while others are decidedly obnoxious and disagreeable. The division of this order known as the Homoptera was dwelt upon at some length by our President in his Inaugural Address, and a number of tree hoppers and their habits were described, as well as a gall insect which, as then explained, makes its galls in countless numbers upon the Hackberry, *Celtis occidentalis*, specimens of which occur near Billings' Bridge, and has received from Prof. Riley the name of *Psylla celtidismamma*. These insects will be found fully described in the Annual Report (1882) of the Ent. Soc. of Ont. Allied to the psyllas are the aphides so destructive to vegetation. These are of numerous species and occur in countless numbers, but they have not yet been investigated here. On 15th Oct., near Hull, such myriads of aphides swarmed in the mellow autumn air that looking across the fields towards the sun there was the appearance almost of a snow-fall, except that the minute living flakes were floating and crossing in every direction, while larger ones with more rapid motions darted in large numbers through the drifting clouds of life; these were insects of different orders, but chiefly flies and beetles. On the following day the pine-aphides were observed laying their eggs on the leaves in rows of 8-10. Their guardians, the ants, ran to and fro and occasionally one was seen dashing about in great excitement and snapping right and left, apparently at some minute flies which hovered about the aphides and which were probably parasites.

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Of the second division of bugs, Heteroptera, a number of species have been collected as occasion offered, but they are mostly unnamed and their habits have not been investigated.

ORTHOPTERA.—This order is a limited one containing but few species—our crickets, grasshoppers, etc.—yet even these few have not been collected nor their injurious habits observed. At the excursion to Des Chenes Lake, 2nd Sep., a pair of the remarkable and rather rare Walkingstick insects, *Diapheromera femorata*, were taken on hickory. Three specimens were also taken near Hull a few days previously. The common grasshopper, *Caloptenus femurrubrum*, so abundant on Parliament Square and elsewhere a few years ago, is now, apparently owing in a great measure to the labours of the English sparrows, not at all numerous, and fishermen seeking them for bait are forced to go some distance beyond the city limits.

NEUROPTERA.—Our dragon-flies, mayflies, shadflies, etc., have not yet been collected, although there are among them some of our most interesting insects. The species are innoxious and often very beneficial in their habits. *Corydalus cornutus*, known in the United States as the Hellgrammite fly, is of such remarkable and formidable appearance as always to attract attention, and specimens have been frequently received. The larvæ are found in great numbers along the Rideau and are extensively used as bait.

ARACHNIDÆ AND ACARIDÆ.—The insects included in these orders differ from all the foregoing in having an additional pair of legs, and are popularly known as spiders and mites. Mr. Tyrrell has been collecting them and has now quite a large collection. The spiders are at present being named, and many of the mites have been already determined.

In conclusion we would request the Council to urge upon the members the importance of the study of entomology, not only for its scientific value but for economic considerations as well, and for the pleasure and profit which will be gained by them. Our forests, fields and gardens are ravaged by almost countless species of insects, while many attack our cattle and poultry and a few even wound us in the

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flesh as well as in the pocket. In compensation there are other species which furnish us with food and raiment, and many which are objects of exquisite grace and beauty.

W. HAGUE HARRINGTON,
J. B. TYRRELL,
Leaders, Entomological Branch 1882-83.

16th March, 1883.

REPORT OF THE ORNITHOLOGICAL AND OÖLOGICAL BRANCH FOR THE SEASON OF 1882.

To the Council of the Ottawa Field-Naturalists' Club:

The leaders have much pleasure in reporting that during the past year a number of members of the Club have taken an active part in the local development of Ornithology and Oölogy, and that some important work has been done.

In order to facilitate work, sub-excursions were held periodically during the collecting season, to various localities in the vicinity of the city. On two of them, held on the 24th May and 19th July respectively, the nesting place of a colony of great blue herons (*Ardea herodias, L.*), was visited. This heronry (which is known to have existed for many years, having been visited by the Ottawa Natural History Society in 1868), is situated on the north bank of the Ottawa River, about half way between McCaul's Bay and the village of Thurso, and is distant about 25 miles from the city, It is located in the centre of a thick swamp, which, on the occasion of our first visit, was so deeply submerged as to bar all ingress. On the 19th July, however, the water was but knee deep. After proceeding about half a mile into the swamp, our attention was arrested by a peculiar sound, which we at first thought must proceed from some distant saw-mill, or steamer on the river. As we advanced, however, the sound resolved itself into most extraordinary noises, some of which strongly resembled the barking or yelping of dogs or foxes. On penetrating still deeper into the swamp, we discovered that the noises proceeded from immense numbers of herons, some perched on the branches of the trees, some sitting on their nests, and

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others flying overhead. The uproar was almost deafening, and the odour arising from the filth with which the trees and ground were covered was extremely disagreeable.

We tramped all through the heronry, and calculated that it must extend at least half a mile in each direction. The trees were swamp ash (*Fraxinus sambucifolia*), and at least two nests were built on every available one, while some of the larger ones contained as many as seven or eight. The clutch seemed in all cases to consist of three; and the nearly full grown young were scarcely to be distinguished in plumage from the adults. When driven from the nest, however, they flew very awkwardly, and alighted as quickly as possible. Numbers of the parents were feeding their young, and the capacious mouths and throats of some which we shot were completely filled with fish, about an inch long, which were evidently intended for food for their hungry offspring. The nests were all of the same pattern—great cumbersome piles of sticks, about a foot thick, but with a very shallow cavity, and no lining. They were placed from twenty to forty feet from the ground, in some instances, next the trunk of the tree, and, in others, some distance out on the large branches. The birds were very tame, making no attempt to fly until we began to climb the trees on which they were; and even then they moved lazily off, and manifested little or no alarm at our near approach to their young. It is surprising that such large and powerful birds should show so little inclination to defend their young; however, as the following incident will show, it is not always in the largest and strongest birds that this instinct is most perfectly developed.

On the 28th June a most peculiar fight was witnessed by Mr. Scott in a willow swamp about four miles from the city. The combatants were a common garter snake (Eutaenia sirtalis Baird and Girard), about a foot and a half long, which was trying to devour a young Wilson's thrush (Turdus fuscescens Steph.), and the parent thrushes, who were endeavouring to rescue it, aided in their efforts by two catbirds (Mimus carolinensis (L.) Gr.) and two robins (T. migratorius L.) The six birds were greatly excited, and every feather stood on end, as each one dashed in turn at the head of the snake. How the latter was defending himself could not be seen, as he was almost com-

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pletely hidden by thick underbrush. The birds were so excited that they allowed the observer to advance to within two or three feet of them, without paying the least attention to him; the snake, however, on seeing someone approach, relinquished his prize, and glided off into the thicket. As soon as they saw the enemy routed, the storm of angry chirps ceased, and the robins and catbirds flew off; while the thrushes, although they continued to give vent to occasional mournful whistles, did not manifest nearly the same anger or alarm at seeing their offspring in human hands, as they did when the snake had posession of it. The young thrush, which had evidently just left the nest, was only slightly skinned on the wing, but was terribly frightened, and died the next day. During the whole of the combat a least flycatcher (*Empidonan minimus* Bd.) was quietly sitting on her nest in the fork of a small willow, only a few feet away, paying not the slightest heed to the exciting scene which was enacting beneath her.

Among the nests found this season might be mentioned several of the white-throated sparrow (Zonontrichia albicollis (Gm.) Bp.) About the 8th August the nest of a common Bittern (Botaurus mugitans (Bartr.) Coues) a collection of oak twigs, placed in the centre of a small clump of *Cassandra calyculata*, was found in Lake Flora Swamp, Hull, with five half-grown young ones in it.

On the 11th July, Mr. Scott found what was probably the nest of a red-eyed vireo (Vireo olivaceus (L.) Veillot) containing two eggs of the cowbird (Molothrus ater (Bodd.) Gray) *almost hatched!* This is a most interesting find, as it has been hitherto supposed that the birds which are forced to do duty as nurses to the cowbird's young, would not hatch the eggs of the intruder, unless some of their own eggs were present.*

The following additions have been made to the "List of birds shot in the vicinity of Ottawa," appended to last year's report, and published in "Transactions" No. 3, of the Club. (The numbers refer to the second edition of Coues' "Check List.")

6. *Turdus mustelinus* Gm., Wood Thrush. This bird is not uncommon with us, and was inadvertently omitted from last year's list.

*Since the above was written, the following has appeared in an article by Mr. W. Dunlop in the *Canadian Sportsman and Naturalist* for June, 1883: "Dr. Brewer mentions a case in which a red-eyed vireo hatched three of these (the cowbird's) eggs without laying any of her own."

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109. *Helminthophila perigrina*, (Wils.) Cab. Tennessee Warbler. A specimen of this rare warbler was shot on the bank of the Rideau River, on the 9th of April last (1882), by Mr. White.

142. *Geothlypis philadelphia* (Wils.), Bd. Mourning Warbler. A male and female of this shy warbler were observed, by Mr. Scott, on two consecutive days, towards the beginning of last July. On both occasions they were hopping about among the branches of a willow, in a little swamp, near the Chelsea road, about four miles from town. Their movements made it probable that their nest was not far distant, but a deligent search failed to discover it. The male bird alone was shot.

147. *Myiodioctes pusillus* (Wils.), Bp. Green Blackcapped Fly-catching Warbler. One specimen of this warbler was shot by Mr. White.

212. *Chrysomitris pinus* (Bartr.), Bp. Pine Linnet, American Siskin. These birds have been very common this winter (1882-83), great numbers of them having been observed feeding on the seeds of the white cedar trees along the banks of the Rideau. Some have even ventured into the city, and a pair were noticed in a vacant lot on Wilbrod Street, eating seeds of lamb's-quarters (Chenopodium album) which reared their tops above the snow. We have no record of their ever having been taken here before.

240. *Ammodramus caudacutus* (Wils.), Sw. Sharptailed Finch. One specimen of this bird was shot last season, and sent to Dr. Coues, who remarked that this locality was both north and west of its usual range.

331. *Scolecophagus ferrugineus* (Gm.), Sw. Rusty Grackle. Every autumn immense flocks of these birds pay us a passing visit, on their southward journey. Specimens have also been shot here in June and July, which makes it probable that they occasionally breed here. This species should have been mentioned in last year's list.

534. *Haliaëtus leucocephalus* (L.), Savig. Bald Eagle. Specimens of this magnificent bird have been seen and shot from time to time in the vicinity of Ottawa; and a live bird, taken up the Gatineau some years ago, is at present living in confinement at the Royal Exchange Hotel.

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626. *Tringa canutus* L., Red-breasted Sandpiper ; Robin Snipe ; Knot. This sandpiper is very rare with us, apparently only visiting us in the fall.

638. *Tringoïdes macularius* (L.), Gr. Spotted Sandpiper. This is the commonest of our shore birds, and breeds here abundantly. It was inadvertently omitted from last year's list.

684. *Gallinula galeata* (Licht.), Bp. Florida Gallinule. This bird, for a long time supposed to be exclusively a southern species, is quite common with us, and probably breeds here. It is somtimes confounded with the coot (*Fulica americana*, Gm.) but is readily distinguished from it by its red frontal plate, and the absence of marginal membranes on the toes. It is a fact worthy of note that, while the gallinule seems to be confined to the Rideau, and its tributary creeks, the coot is found exclusively on the Ottawa.

Two ducks, a male and female, which appeared to be hybrids between the mallard (*Anas boscas*, L.) and the black duck (*A. obscura*, Gm.), were shot on the Ottawa by Mr. White.

718. *Spatula clypeata* (L.), Boie. Shoveller Duck. A few specimens of this duck were shot on the Rideau River, last fall.

854. *Fratercula arctica* (L.), Steph. Common Puffin ; Sea Parrot. A young bird of this species was shot on the Ottawa, towards the end of October, 1881 (after the report for last year had been handed in.) It had probably been blown inland by a severe storm, which took place some days previous.

Mr. White, last season, obtained additional specimens of the yellow-winged Sparrow (*Coturniculus passerinus* [Wils.] Bp.), thus placing the occurrence of that species in this locality beyond question.

The leaders regret that several mistakes were inadvertently allowed to get into the report and list of birds published last year. The following corrections, therefore, require, to be made :—

Page 27, line 6, for Imelin, read Gmelin ; line 10, for Columbus, read Colymbus ; line 13, for Halialtus, read Haliaetus ; line 25, for Sayomis, read Sayiornis ; page 28, line 5, for Harporhynchus cinereus, Baird, read Harporhynchus rufus, Cab. ; line 26, for Cones, read Coues. In the list : Omit No. 12 ; for "34 *Parus rufescens*, Townsend, Chestnut-backed Chicadee," read "33 *Parus Hudsonicus*, Forster,

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Hudsonian Chickadee;" for "132 *Vireo pusillus*, Coues, Least Vireo," read "125 *Vireo gilvus*, Bp., Warbling Vireo;" page 31, No. 183, for *lencophrys*, read *leucophrys*; omit No. 329. After No. 337 read: "One specimen seen by Lieut.-Col. and Mr. Geo. R. White. When observed it was sitting on a flagstaff, at the Rideau Rifle Range. It was, unfortunately, not secured, but it was examined closely through a glass; and, as there is no bird with which it could be confounded, there can be no doubt as to its identity." No. 337, for "Sharp-skinned," read "Sharp-shinned;" omit No. 398; No. 406, for "Brown," read "Brant;" for "470 Porzana Jamaicensis, Cass., Black Rail," read "467 Rallus Virginianus L., Virginia Rail.;" No. 507, for "Buffalo-headed," read "Buffle headed;" for "555 Larus Franklinii Rich," read 556 Larus Philadelphia Coues."

Last Spring (1882) birds were first seen on the following dates:

Feb'ry 18—Shore Lark, *Eremophila alpestris* (L.) Boie.
March 8—Robin, **Turdus migratorius*, L.
" 26—Purple Finch, *Carpodacus purpureus* (Gm.) Gr.
" 29—Bluebird, *Sialia sialis* (L.) Hald.
" 30—White-bellied Swallow, *Iridoprocne bicolor* (V.) Coues.
April 1—Wood Peewee, *Contopus virens* (L.) Cab.
" 3—Purple Martin, *Progne subis* (L.) Bd.
" 3—Purple Grackle, *Quiscalus purpureus* (Bartr.) Licht.
" 4—Snowbird, *Junco hiemalis* (L.) Scl.
" 4—Golden-crested Kinglet, *Regulus satrapa*, Licht.
" 4—Song Sparrow, *Melospiza fasciata* (Gm.) Scott.
" 7—Peewee, *Sayiornis fusca* (Gm.) Bd.
" 7—Cowbird, *Molothrus ater* (Bodd) Gray.
" 7—Marsh Hawk, *Circus cyaneus hudsonius* (L.) Coues.
" 7—Herring Gull, *Larus argentatus*, Brunn.
" 8—Red-winged Blackbird, *Agelæus phœniceus* (L.) V.
" 8—Rusty Grackle, *Scolecophagus ferrugineus* (Gm.) Sw.
" 9—Black-and-white Creeper, *Mniotilta varia* (L.) V., and several other warblers.
" 10 - Wood Duck, *Aix Sponsa* (L.) Boie.
" 10—Goosander, *Mergus merganser*, L.
" 10—House Wren, *Troglodytes domesticus* (Bartr.) Coues.
" 15—Kingfisher, *Ceryle alcyon* (L.) Boie.
" 16—Sparrow Hawk, *Falco sparverius*, L.
" 19—Black Duck, *Anas obscura*, Gm.

*As one had been shot on the previous 20th December, and as the season was a peculiarly open one, it seems not improbable that some of these birds may have remained all winter.

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April 19—Fish Hawk, *Pandion haliaëtus* (L.) Sav.
" 22—Golden-winged Woodpecker, *Colaptes auratus* (L.) Sw.
" 24—Meadow Lark, *Sturnella magna* (L.) Sw.
" 25—Hooded Merganser, *Mergus cucullatus*, L.
" 26—Spotted Sandpiper, *Tringoides macularius* (L.) Gr.
" 28—Wilson's Snipe, *Gallinago Wilsoni* (Temm.) Bp.
May 2—Barn Swallow, *Hirundo erythrogastra horreorum* (Bartr.) Coues.
" 2—Sand Martin, *Cotile riparia* (L.) Boie.
" 4—Blue-winged Teal, *Querquedula discors* (L.) Steph.
" 14—Baltimore Oriole, *Icterus galbula* (L., 1758) Coues.
" 14—Rose-breasted Grosbeak, *Zamelodia ludoviciana* (L.) Coues.
" 18—White-throated Sparrow, *Zonotrichia albicollis* (Gm.) Bp.
" 18—Golden-crowned Thrush, *Siurus auricapillus* (L.) Sw.
" 18—Brown Lark, *Anthus ludovicianus* (Gm.) Licht.

A large flock of White-winged Crossbills (*Loxia leucoptera* Gm.) was seen near Beechwood last June.

Large numbers of the Ruddy Duck (*Erismatura rubida* [Wils.] Bp.) arrived here early and stayed late last fall.

This winter (1882-83) unusually large numbers of Pine Grosbeaks (*Pinicola enucleator* [L.] V.) have been observed. They arrived in October, which was early for them, and, at present, they show no signs of an intention to depart. They are very tame, and may be seen boldly searching for food on some of the most public streets of the city.

GEO. R. WHITE,
W. L. SCOTT.

16th February, 1883.

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NOTES ON TRIARTHRUS SPINOSUS, BILLINGS.

HENRY M. AMI, B.A.

Recent and more detailed observations have brought out new and remarkable features as belonging to this very interesting little trilobite.

The species, as originally described by Billings, is said to possess *four* spines, thus described by him in the Report of Progress of the Geological Survey of Canada for the years 1853-56, page 340:

"One of these springs from the centre of the neck-segment and extends backwards to the third or fourth segment of the body; a second proceeds from the centre of the eighth segment of the axis of the thorax and projects back beyond the apex of the pygidium. Two others, from posterior angles of the head, extend as far as the points of the seventh or eighth pair of pleura. The spines are all slender, apparently cylindrical, and about one-fifth of a line in diameter."

Thiarthrus spinosus. (after Billings.)

These salient characters separate this species very readily from any of the other two species described by Billings, viz.:—*T. glaber* and *T. Fischeri;* also from *T. Canadensis*, Smith, described in the Canadian Journal for 1861, page 275, and from the common, *T. Becki*, Greene, in his monograph, p. 87.

In a paper read before the Ottawa Field Naturalists' Club during the winter of 1881-82, on "The Utica Slate Formation," the writer had occasion to notice, in regard to the same species, that whilst the majority of specimens found indicated in the presence of a spine on the *eighth* thoracic segment, still, in a few specimens he was able to observe another spine on the *ninth* thoracic segment. It was this fact which led him to say: "for the present we are satisfied with stating that it (*T. spinosus*) possessed at least more than four spines."

Now, the most perfect specimen yet procured from the deposits of the Utica at Cummings' Bridge, Gloucester, Ont., shows clearly that, not only did the species in question possess "more than four spines," but that the eighth, the ninth, and likewise the tenth thoracic segments of the one individual have each a spine proceeding from the central portion of their axis, which three spines, along with that on the *occipital*

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or neck-segment, and the two curved ones attached to the posterior angles of the cephalic shield, give as many as *six* spines, which *Triarthrus spinosus*, Billings, possessed. These facts are not founded on this specimen alone, for there are several others, less perfect however, which show the same characters. Of those three spines on the back of the trilobite we find that the anterior one appears to be the shortest; it, however, extends "beyond the apex of the pygidium;" the posterior one is somewhat longer than the anterior, whilst the intermediate one is very long indeed—about twenty millimetres; it is the longest spine of the individual, and projects over ten millimetres beyond the apex of the pygidium. All these spines are more or less cylindrical, attenuated to a sharp point—the longest one appears to be grooved below, no doubt to allow it to rest partially over the posterior one. *(See Plate.)*

It is somewhat difficult to imagine how it happens that so many specimens have been collected by different individuals, which show only one spine on the thoracic segments and that on the eighth. It may be due in part to the state of preservation of the specimens and delicacy of these spines, which, perhaps, were quite brittle (a mere fragment of the point of attachment often indicating the previous presence of the spine), else some solution may be found in the fact that the eight anterior thoracic segments are held so close together, being scarcely ever separated, whilst, beginning with the ninth thoracic segment, the remainder of the segments, down to the pygidium, are almost invariably found detached and separated from each other.

T. spinosus, when adult, has been observed to possess as many as thirteen segments in the thorax (Billings and others); therefore, between the eighth thoracic segment and the pygidium, there would be normally five segments; of these, we know that two at least possessed spines. From the evidence gathered in the examination of numerous specimens, it would not be at all surprising to discover that from the eighth to the thirteenth segments each had a spine proceeding from the centre of the axis; were such the case the species would be much more spiny than at first it was thought to be—as it would possess not "four," nor "at least more than four," nor more than "six," but *nine* spines.

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OTTAWA FIELD-NATURALISTS' CLUB

Transactions No. 5

VOLUME II, NO. 1.

OTTAWA, CANADA.
Citizen Printing and Publishing Company, Metcalfe St.
1884

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OTTAWA

FIELD-NATURALISTS' CLUB.

TRANSACTIONS NO. 5.

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OTTAWA, CANADA.
CITIZEN PRINTING AND PUBLISHING COMPANY, 31 METCALFE STREET.
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Fuller, Thos., *R.C.A.*

Garvock, W. B.
Geddes, Alfred.
Gemmill, J. A.
Giroux, N. J.
Grant, Miss Isabel L.
Grant, J. A., *M.D., F.R.C.S., F.G.S., F.R.S.C.*
Grant, Miss Jessie.
Grant, Miss Mary.
Greene, G. M.
Griffin, W. H.
Grignard, A.

Hale, J.
Hardie, John.
Hardie, T. Melville.
Harmon, Miss A. Maria.

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Harrington, W. H.
Harrington, Mrs. W. H.
Harris, W. Dale.
Harrison, Edward.
Hodgins, John.

Johnson, Geo.
Johnson, E. V., *C.E.*

Kearns, J. C.
Keeley, D. H.
Kilgannon, A. P., *C.E.*

Lambart, *Hon.* O. H.
Lampey, Wm. G.
Latchford, F.R., *B.A.*
Lee, Miss K. G.
LeSueur, W. D., *B.A.*,
LeSueur, Mrs. W. D.
Lett, W. P.
Lindsay, A.
Loux, Wm., *M.D.* (Russell).
Lowe, John.

MacCraken, John I., *B.A.*
McConnell, R. G., *B.A. Sc.*
McGill, A., *B.A. Sc.*
MacLaughlin, T. J.
McLaughlin, S.
McLean, J. D.
McMillan, John, *M.A.*
Macoun, John, *M.A.*, *F.L.S.*, *F.R.S.C.*
Macoun, J. M.
Martin, E. D.
Matheson, D.
May, George.

Nicholson, M. Vernon.

Odlum, E., *M.A.*, (Pembroke).
Oxley, James M., *LL.B.*

Parris, Miss Oriana.
Parris, Wm.
Perley, Henry F., *C.E.*
Poirier, P. S.

Rauscher, Rudolf.
Richard, Louis N., *B.A. Sc.*

Sawyer, D. J. B.
Scott, Miss Lilian.
Scott, R. D'Arcy.
Scott, Wm.
Scott, W. L.
Selwyn, A. R. C., *LL.D.*, *F.R.S.*, *F.R.S.C.*
Shaw, James F.
Short, John.
Small, H. Beaumont, *M.D.*
Small, H. B.
Smith, Henry R.
Smith, W. H.
Sowter, E. T. W.
Steers, C. J.
Stewart, J. C.
Summerby, Wm. J., *M.A.*(Russell).
Symes, Miss E.
Symes, P. B., *A.K.C.*

Thorburn, John, *M.A.*, *LL.D.*
Tomlinson, J., *C.E.*
Tyrrell, J. B., *B.A.*, *F.G.S.*

Verner, J. W. D.

Watters, Henry.
Watts, J. W. H., *R.C.A.*
Warwick, F. W. (Buckingham).
White, Geo. R.
White, *Lieut-Col.* Wm.
Whiteaves, J. F., *F.G.S.*, *F.R.S.C.*
Whyte, Miss Isabella.
Whyte, J. G.
Whyte, R. B.
Whyte, Mrs. R. B.
Wicksteed, R. J., *B.C.L.*, *LL.D.*,
Willimott, Chas. W.
Wood, H. O., *P.L.S.* (Billings Bridge).
Wright Geo. C. (Hull).
Wright, W. R.

Young, James.

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ANNUAL REPORT OF THE COUNCIL.

To the Members of the Ottawa Field-Naturalists' Club:

In presenting a report on the work of the Club during the year just closed, the Council can claim that a large amount of valuable work has been accomplished. Through an oversight in last year's report no mention was made of the Botanical Class which had been conducted during the winter (1882-83) by the President, Mr. James Fletcher. The class was continued in the field during the past collecting season with great success, and has added much botanical strength to the Club. Four regular excursions of the Club were held during the summer. The first was on the 26th May to Kingsmere, a favourite resort of the members. The second was to Casselman on 23rd June, and was perhaps the best excursion yet held by the Club. The third was a very pleasant trip to Buckingham on 2nd August, while the fourth, through the kindness of Capt. Goulet, of Aylmer, who placed a steamboat at the disposal of the Club, was to the beautiful Chats Falls on 12th September. In addition, many sub-excursions were held by the different branches on Saturday afternoons, which aided largely in investigating the natural history of the localities visited. Seven soirées were held during the winter, at which valuable papers and reports were presented, and at which the attendance was very satisfactory. A synopsis of the discussions has been prepared with a view to publication in the Transactions. Classes have been conducted by Prof. Macoun and Mr. Fletcher, in Ornithology and Botany respectively, which will undoubtedly add to the future working strength of the Club. For the prizes announced by the Council for the best collection made during the year in each branch there were no competitors except in Botany, for which the prize—a copy of Gray's manual—has been awarded to Miss Isabel L. Grant, as recommended in the report of the leaders of the branch. For the prize offered by the President, Dr. Small, there were no competitors. The Librarian reports that a large number of

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exchanges have been received, and that 71 copies of Transactions have been distributed to various societies and correspondents of the Club. Owing to a series of unavoidable delays, the Transactions (No. 4) for 1882-83 were not published as early as would have been desirable, but arrangements have been made with a view to prevent a repetition of such delays in publication. To improve the standing of the Club and to enable it to apply to the Ontario Government for a grant to assist it in carrying on its work, it was found necessary to have it incorporated, and the requisite papers were accordingly prepared and registered by Messrs. Scott, MacTavish & MacCraken, who very generously declined to accept any fee from the Club therefor. A petition for a grant was also prepared and forwarded to the Minister of Education. Under the conditions of incorporation, it becomes necessary to make an amendment to one of the rules, and it is proposed at the same time to make such other amendments as may be deemed advisable in order to secure the most satisfactory management of the Club. Thirty-nine new members were elected during the year, and the present membership is 128, as compared with 108 reported last year. The Rev. Duncan Anderson, M.A., of Spruce Cliff, Levis, Que., a prominent Ornithologist, was elected a corresponding member. The Treasurer's balance sheet shows that there are no claims outstanding against the Club. The reduction in the balance reported is due partly to an increase in several items of expenditure, and partly to a decrease in the amount of back fees received, and in the sale of Transactions. Nineteen meetings of the Council were held during the year, at which there was an average two-thirds attendance of the members, notwithstanding the absence of several of them from the city during the summer. In conclusion, the Council has much pleasure in informing you that His Excellency the Marquis of Lansdowne has graciously consented to become Patron of the Club in the place of our late Governor General the Marquis of Lorne.

W. H. HARRINGTON,

Secretary.

OTTAWA, 18th March, 1884.

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TREASURER'S STATEMENT

Of Receipts and Expenditure for 1883-84.

RECEIPTS.		EXPENDITURE.	
Balance from 1882-83...	$ 40 31	Stationery, Printing, etc.	$ 25 76
Membership Fees.....	109 00	Excursion Expenses.....	23 58
Excursion Receipts.....	24 20	Soirée do	11 95
Soirée do	6 10	Cost of Transactions No.4	116 25
Sales of Transactions...	10 25	Balance on hand	12 32
	$189 86		$189 86

WM. P. ANDERSON,
Treasurer.

18th March, 1884.

LIBRARIAN'S LIST OF DONATIONS AND EXCHANGES.

New Brunswick Natural History Society:—"Bulletin." No. 2.

Massachusetts Horticultural Society:—"Transactions," 1883. Part I. "Schedule of Prizes," 1884.

Montreal Natural History Society:—"Canadian Naturalist." Vol. X, Nos. 7 and 8. "Canadian Record." Vol. I, No. 1.

Buffalo Naturalists' Field Club:—"Bulletin." Nos. 3, 4 and 5.

Boston Zoölogical Society:—"Quarterly Journal." Vol. II, Nos. 2, 3 and 4. Vol. III, No. 1.

Cambridge Entomological Club:—"Psyche." Vol. III, Nos. 101-2. Vol. IV, Nos. 105-116.

Joseph M. Wade:—"Ornithologist and Oölogist." Vol. VII, Nos. 13-24. Vol. VIII, Nos. 1-12.

John B. Smith:—"N. A. Heliothinæ."

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American Museum of Natural History:—"14th Annual Report." "Bulletin." No. 4.

Henry Edwards:—"Papilio." Vol. III, Nos. 3-10.

Canadian Institute:—"Proceedings." Vol. I, No. 4, 5.

College of Ottawa:—"Prospectus and Course of Studies, 1883-4."

Joseph F. James:—"Revision of the Genus Clematis of the U.S."

Epping Forest and County of Essex Naturalists' Field Club:—"Transactions." Vol. III. Part 7.

Physikalisch-Ökonomischen Gesellschaft, Königsberg. Schriften der—1882.

Prof. J. Macoun:—"Catalogue of Canadian Plants." Part I.

Academy of Natural Sciences, California:—"Constitution and By-laws." "Proceedings." Vols. V, VI, and Part 1 of Vol. VII.

George Dimock:—"Minutes of Meetings of Cambridge Entomological Club, 1883." "Microscopy and Histology."

G. E. Davenport:—"Catalogue of the Davenport Herbarium." "Supplement to ditto." "Distribution of Ferns in U.S.A."

R. H. Ward:—"Report on Micrometry."

Toronto Natural History Society:—"Check and Label Lists of Insects of Canada."

United States Geological Survey:—"Second Annual Report," 1880-81. "Hayden's Geographical and Geological Surveys of the Territories." Parts 1 and 2 (1878). "Maps for ditto." "Monograph, No. 2, Tertiary History of the Grand Canyon District, Dutton." "Atlas for ditto." "Bulletin." No. 1.

Lambeth Field Club:—"Report," 1882.

American Association for the Advancement of Science:—"Proceedings Montreal Meeting," 1882.

James Fletcher:—"Reports of Ontario Fruitgrowers' Association," 1881 and 1882.

Torrey Botanical Club:—"Bulletin." Vol. XI, Nos. 1 and 2.

J. A. Lintner:—"First Annual Report of the State Entomologist of New York State."

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CONSTITUTION.

(*Adopted at a Special General Meeting held 28th March,* 1884.)

1. *Name and Object.*—This Club shall be called the Ottawa Field Naturalists' Club, and its object shall be the study of the Natural History of this Locality.

2. *Officers.*—The Officers of the Club shall consist of a President, first and second Vice-Presidents, a Secretary, a Treasurer, and a Librarian, who, together with three other members of the Club, shall form a Council, all of whom shall be elected annually, and shall be eligible for re-election, and who shall have the management of all the business of the Club. In the event of any vacancy occurring in the Council during the year the same may be filled by the election of a successor at any of its regular meetings.

3. *Auditors.*—There shall be two Auditors, elected annually, to examine the Treasurer's accounts for the following year and report thereon at the next annual meeting.

4. *President and Vice-Presidents.*—The President shall direct all the business of the Club, and preside at all meetings of the Club and Council; his duties, in the event of his absence, devolving on the Vice-Presidents in their order.

5. *Secretary.*—The Secretary shall give previous notice to each member of the Club of every meeting of the Club, and to each member of the Council of every meeting of the Council; shall make and keep a true record of the Proceedings of all Meetings of the Club and of the Council; have custody of the Constitution, By-laws, and Records of the Club, and conduct its general correspondence.

6. *Treasurer.*—The Treasurer shall be charged with the collection and custody of the funds of the Club, and keep a regular account thereof, which shall always be open to the inspection of the Council. He shall also submit at each annual meeting a statement showing the financial condition of the Club.

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7. *Librarian.*—The Librarian shall have charge of all publications of the Club, and shall distribute the same under the direction of the Council. He shall also have the custody of all books and papers belonging to the Club, and shall supervise their circulation among the members.

8. *Council.*—The Council shall, as business may require, meet from time to time at the call of the President, or of any two officers; shall control all matters affecting the welfare of the Club, subject to this Constitution; shall have full control of the funds of the Club, and shall report its proceedings to the members at the Annual Meeting.

9. *Annual Meeting.*—The Annual Meeting of the Club shall be held on the Third Tuesday in March, at which, in addition to other business, the Annual Report of the Council shall be read, and the Council and Auditors for the following year elected, by ballot after nomination, by a majority of the members present.

10. *Special Meetings.*—A Special General Meeting of the Club may be called by the Council; and shall be called on requisition of not less than ten members, specifying the business they wish brought before the meeting. The Council shall call the meeting within fourteen days from the receipt of the requisition, giving one week's notice. No other business shall be transacted than that mentioned in the notice.

11. *Conduct of Meetings.*—The presence of ten members shall be required to constitute any general meeting of the Club, and of three members to constitute a meeting of the Council. All meetings shall be conducted under such by-laws and rules of procedure as may from time to time be adopted.

12. *Proceedings.*—Excursions in summer, and Evening Meetings and Classes of Instruction in winter, shall be held, and the Transactions of the Club shall be periodically published; all arrangements for which shall be made by the Council.

13. *Members.*—Any lady or gentleman desiring to join the Club shall send a written application, signed by the applicant and endorsed by the recommendation of two members, to the Secretary, and if approved shall be elected at the next meeting of the Council. Members desiring to leave the Club must previously settle all dues and signify their intention in writing to the Secretary.

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14. *Corresponding Members.*—The Council shall have the power of electing Corresponding Members, who shall be persons not residing in Ottawa or its immediate vicinity, but who may be desirous of promoting the objects of the Club. Corresponding Members shall not be required to pay membership fees.

15. *Annual Fee.*—The annual membership fee shall be one dollar, payable in advance, due on the third Tuesday in March, and no member in arrears shall be entitled to any of the privileges of the Club. New members to pay the fee for the current year upon election. The payment of the annual fee to entitle a member to receive a copy of the Transactions, as published, and to admission to the Club Soirées, without further charge.

16. *Amendments.*—This Constitution may not be changed or amended except by a special meeting of the Club called for that purpose, and by a two-third vote of the members present.

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REPORT TO THE ROYAL SOCIETY OF CANADA.

(Read at the Second General Meeting, May, 1883.)

In the rules adopted at the organization of the Club which I have the honour to represent, its object is thus briefly stated: "to study the Natural History of this locality." During the four years of its existence, a strictly local character has been maintained, and to this we ascribe whatever success the Club has attained. The general management is under the control of the usual officers, elected annually, but the scientific work is directed by "Leaders" selected by the Council. The duties of these "Leaders" are:—To render any assistance in their power to members engaged in collecting and studying in their respective branches; to bring together for mutual aid and encouragement the members interested in the same subject; to organize and direct working parties; to keep notes of work done, and to report to the Council at the close of the season.

We are divided into six sections:—Geology—including Palæontology; Mineralogy and Lithology; Botany; Entomology; Conchology; Ornithology; General Zoölogy.

During the summer our work is entirely in the field. Once a month an excursion is held to some point ten or twelve miles distant, which is well attended, not only by members, but also by their friends. On the first and third Saturdays of each month, afternoon expeditions are taken by members of each branch, under the direction of the Leaders. In addition, throughout the whole season individual work is prosecuted with much zeal and assiduity.

In the winter, evening meetings are held once a month. Papers, bearing on the work done during the summer, are read and discussed; collections and specimens are exhibited, and the reports of the Leaders are received. Classes have been conducted for beginners in Botany and Entomology, and it is intended to form others as they may be found requisite in any branch. Prizes are given by the Club for the best collection in each branch. The President also offers a prize for the best record of original work.

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That the advantages of the Club may not be confined to the members, nor the results of our labours be lost to the future, Transactions are published annually. They contain the President's address; the Secretary's report; reports of progress in the sections; lists of objects collected and the papers read at the winter meetings. Perhaps the most valuable are the lists. Those of plants, insects, birds, fishes and shells are already very complete. Each year they are added to and new ones commenced. The papers are altogether upon local subjects, and partake both of scientific and economic interest. A few titles will convey an idea of their character:—Geology of the Ottawa Palæozoic Basin, by Dr. Selwyn; Cystidean Life, by Dr. Grant; Laurentian Rocks, by Mr. Adams; Asbestos, by Mr. Anderson; and Coleoptera, injurious to our Pines, by Mr. Harrington.

The Museum which we aid our sister society, the Literary and Scientific, in maintaining, also partakes of our exclusive character, consisting entirely of collections made in this vicinity. In a few years we hope to have a museum in which the whole natural resources of this district may be easily studied.

Our steady growth and extending influence are very gratifying. Our Club is under the distinguished patronage of His Excellency the Governor-General, and the roll shows some 120 members; among them being the names of no less than eight Fellows of your Honourable Society. Letters seeking information are continually received, not only from residents of this neighbourhood, but also from more distant towns. Our "Transactions" and our system have been most favourably commented upon by the leading scientific journals of America, England and Europe; and the continued energy of our members leads us to hope that the vigour of our future will be as marked as that of our past.

H BEAUMONT SMALL, M.D.,
Delegate.

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PRESIDENT'S INAUGURAL ADDRESS.

H. Beaumont Small, M.D.

(delivered 6th december, 1883.)

Members of the Ottawa Field-Naturalists' Club, Ladies and Gentlemen:

It is with feelings of pleasure mingled with fear that I find myself in the position to welcome you upon this the fifth year of our Club's history. To feel that I have been considered worthy of occupying the position of President is an undoubted pleasure; yet there is ever the fear that the honour entrusted to me is greater than I have the power to maintain. Your confidence, I can assure you, has been appreciated; and, in addition to what my actions may imply, I will simply ask you to accept my most hearty thanks for placing me in this honourable position. From its beginning the Club has ever had my co-operation and good wishes; its welfare I have ever striven to promote. The incursions into the realms of Dame Nature, and the friendly intercourse with fellow members have always proved a source of pleasure and relaxation from other more serious duties of everyday life.

The acceptance of the office was not without deep consideration on my part. I felt its importance—was aware of the duties it would require—knew that much time would have to be devoted to its work—and weighing all these things carefully, I accepted it, trusting to your forbearance, determining to fulfil all its obligations to the utmost of my ability. Perhaps that which lent greatest weight to my decision was the friendly relations existing with all my *confrères* in the Council, upon whom I felt I could rely for every aid to make my term easy and successful.

Of the many difficulties that must of necessity be met, one in particular will ever overshadow all my efforts. I refer to the brilliant career of my predecessor in office, for a more untiring, energetic officer, or a more successful period in the history of any club, could not be wished for. Previous to 1879 Natural History in Ottawa ran at

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random. Such societies as had been formed were devoted to science in general; very little work of any local value had been handed down to us; no effort had been made to study the resources of this neighbourhood; there had been no practical working parties, no co-operation of forces; each student followed his own bent, and in many cases trod an unencouraged and unsympathetic path. Seeing what a field there was to work, and knowing how much could be accomplished by united efforts, our worthy ex-President conceived the idea of the Club; his energy carried it into effect, and his contagious zeal and activity have maintained its successful career. During one year as Vice-President, and three successive years as President, the bulk of the labour fell on his shoulders, not only the arduous duties of managing, but also the more valuable work of directing the various branches of natural history, for there is hardly a branch in which there is not some student who can trace a fondness for nature to his assistance and enthusiasm. The result of his efforts is such as he can look at with pride, and were nothing further accomplished he has done enough to have his name for ever associated with the development of our local natural resources. To those who remember the condition of the study of natural science before the formation of this Club, its present popularity and progress tell of a very material change. Workers are now united and their efforts systematized. Numbers have been induced to enter upon the study, some of whom form our most active members. Branches hitherto unnoticed now possess energetic searchers.

Our Transactions are very creditable. They place on record much local information, valuable not only to us as residents, but to all others, more especially those who may reside here in the future. The geology and stratigraphy are very clearly explained, many minerals of economic value are described, the lists of plants, birds, fishes and shells are of incalculable value; each year they are added to and perfected, new ones commenced, and before another four years shall have passed, the resources of this district will be so thoroughly known that we shall be sighing for fresh fields to explore and conquer. Already longing eyes are being cast upon surrounding regions. Our limits will soon become a question requiring deep consideration, but I can see that our domain will eventually comprise all that natural basin drained by the Ottawa

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River; our chief care being not to extend it too rapidly, but only as each foot of ground is worked. Our published lists must continue to comprise only such objects as may be obtained in a day's outing; or when they are from any greater distance the locality must be specially named.

With such a record for the Club, what wonder that I fear the difficulty of maintaining its good name and aiding in its bright future. The vista presented to our view is unlimited, for not only is the perfecting of our neighbourhood before us, but a national work has been begun—could our example but start similar clubs in other districts, their work when added to ours would complete a system unequalled for simplicity and completeness. The scheme is quite feasible. Already several clubs have written for our rules and have commenced a system of field-work. There are naturalists in every district, to start whose energies some central force only is required. Could our national centre of Natural History but see its way clear to assume this duty, the most favourable results would inevitably follow.

During the period that has elapsed since I entered into office much work has been accomplished. The summer has come and gone, during which season the Club has exhibited great activity. This is really the most important period of our year, and the field-work that by which we must hope to maintain our reputation. To its attractions we owe the favour in which the Club is held, and the popularity it has gained, and by it we must strive to retain the interest of the members. During the present year the Council has given special attention to such work. In the intervals between the regular excursions—in addition to the frequent afternoon and early morning outings—sub-excursions were held every second Saturday afternoon. The leaders received the names of those who wished to accompany the parties and notified each one of the spot to be visited. When the locality was favourable two or more divisions would unite. The progress in some branches has been very pleasing, encouraging the leaders to continue such outings another season, with hopes of still greater success. The regular excursions were also as numerous as in previous years. It was feared that the sub-excursions would detract from the success of these larger gatherings, but the results show that our fears were not realized. The opening of

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the Canada Atlantic Railway has brought new districts within our limits. All who visited Casselman must have been charmed with it as a favourable locality for all departments of natural history. The vast expanse of primeval forest, too soon to be invaded by the lumberman's axe, affords an opportunity of studying nature that must be seized by our botanists. Late in the season Capt. Goulet, of Aylmer, conveyed the Club in one of his steamers to the "Chats" rapids, affording a most enjoyable excursion, and the members who took advantage of his kindness, have, I am happy to announce, presented him with a valuable binocular glass as a mark of their appreciation.

In the month of May the meeting of the Royal Society brought many eminent naturalists to our city. It is to be regretted that the Club did not in some way publicly receive them, so as to enable the members to become acquainted with its savants. Another year it is hoped steps will be taken to remedy this oversight. As you are aware the Council of that Society, in order to inform themselves upon the condition of science and literature in the country, invited representatives of leading societies to be present at their meeting, and report upon their individual work. The courteous manner in which the representatives of societies were received and the privileges extended to us made the meeting one continuous source of pleasure. When the reports were read I felt proud of the Club I represented, as no other showed such practical work and usefulness as our own, while the many complimentary remarks received afterwards gave evidence that our system had attracted attention. The papers read were of no interest to us as a local Club, they dwelt upon science in general. Several papers were read by members of our Club, but as they were also Fellows of the Society we received no credit for them. Should any other members at future meetings wish to present papers, they may do so through their representative, and they will certainly be received with the attention they deserve.

The removal of the Ottawa Literary and Scientific Society to their new and more suitable quarters was seized upon as an opportunity to secure a permanent place of meeting. As that Society had decided to remodel their museum, continuing one of a local character only, and as it was necessary for us to possess a permanent collection of specimens,

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rather than form a second and what would have been a rival one, we offered to supply theirs, in consideration of permanent rooms. The conditions are the same as formerly, but as more attention is now to be devoted to the museum, our members will be expected to contribute more freely. The curator will inform us what the museum possesses, donations may then be sent to the Council, who will see that the gift is properly credited. Let us be free and liberal, keeping the Society in our debt; they have always acted in a friendly manner; let all our endeavours be to continue the amicable relations that should ever exist.

Our winter soirées will continue as in the past. The programme prepared presents many features which must prove attractive. The papers of Dr. Dawson and Professor Macoun upon subjects regarding which they are so eminent authorities, will be highly instructive. The paper by Mr. Odlum, one of our new members, residing in Pembroke, is a new feature. This talented gentleman has kindly consented to visit us for the purpose of reading his paper and being present at one of our meetings. I would remind you that in addition to the published subjects there will always be room for notes and communications from the members. It is not necessary that they should be of marked scientific value; some uncommon visit of a bird or insect, or an unusual growth of a plant will prove of interest, and anything that causes discussion will be of value. Should information be required on any point, queries will not be out of order. The result of the summer's collecting may be exhibited that we may learn what others are doing or what the Club possesses. Each one should feel that the success of the evening in part depends on himself. The aim of all should be to make it as interesting and as profitable as possible, so that we may have, not one long formal lecture, but short papers followed by discussions of an informal character, becoming even conversational. This year we intend to take notes of the discussion, and embody in the Transactions such remarks as are of a local character bearing upon the subject.

The usual prizes are offered to the members for competition. The Club prize remains unchanged; that given by the President embraces a wider field than hitherto, for confining it to additions to published lists was not productive of such good results as was expected, and it is

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now open to papers on original work in any department. This, it is hoped, will cause some to exercise their power of observation and impel them to advance in the domain of original research—that only true means of making science progressive.

There is one point I would ask you to think over before the annual meeting, that is the name of the Club, which, I think, should be changed, so that it will read the Ottawa Naturalists' Field Club, instead of the Ottawa Field-Naturalists' Club. The change of a name is a serious matter always. Here it can hardly be called a change, rather an alteration, and in my opinion a correction.

It affords me much pleasure to be able to announce that His Excellency the Marquess of Lansdowne has graciously consented to become the patron of the Club, and I can only hope that our work may prove as interesting to him as it did to his predecessor, the Marquess of Lorne, who always spoke in the kindest manner of our efforts.

To a person following the study of natural history, nothing is more essential than a knowledge of the system by which the members of that vast kingdom are classified. Without this a very important purpose of a name is lost. A name is not simply for the purpose of saving a description when we wish to indicate an object, but it is also intended to intimate the group to which it belongs, and its position or rank in the natural series. The former is of course of primary importance, but the latter is the deeper and more scientific meaning, the inability to apply which constitutes the difference between the ordinary observer or collector and the naturalist.

A person about to travel to a strange country looks on the map to find the position of the spot he is about to visit, notes what other places there are in the neighbourhood and their relative distances. So upon entering the domain of nature should one glance over the map of that country. He should search for his special province and compare it with others, that he may learn its relative position and extent. He should make himself acquainted with its boundaries, and should become familiar with the bordering districts. Should this information be wanting, one of the greatest sources of gratification is lost. In an ordinary ramble innumerable interesting objects are passed by and not

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noticed. The characters which rank one object above another are not known. Relations and analogies of the greatest importance fail to attract attention, nor does he recognize a part in its many modifications. Upon entering a museum such knowledge is again requisite to appreciate what is gathered there. We can only pity the person who wonders why bats are not with birds, or why snakes, eels and worms are in different cases.

Throughout nature there are certain principles or relations which, when searched for, furnish the only true guides, and very few observations of these show that nature has undoubtedly followed a certain plan in producing organized beings. As these beings are scattered all over the globe, inhabiting different elements, this plan is considerably altered and disfigured by modifying influences. The aim is to discover this plan, to trace it through intricate paths, to recognize it in various disguises, and when fully worked out, to draw the lines of demarcation which serve to divide and sub-divide such groups as may be formed. To accomplish this end, the affinities which one object bears towards another must be closely studied. In the animal kingdom those of real importance are found in the internal vital structures, where we must search for the resemblances of a permanent character. A single organ or set of organs may be selected and followed through its many stages, but the greatest precision is obtained when the organism is considered in the totality of its parts. The external markings though not to be depended upon for permanent characters are found to be of value in determining the minor differences and forming the lesser divisions. However, as the same influences that modify externally affect the internal arrangement to some extent, these more crude characters serve to point out the path we wish to follow.

Such principles may be discovered in all systems having any claim to be natural, their correctness depending on the closeness with which the guide has been followed. In the system of Aristotle, formed more than two thousand years ago, we find the first evidences of a natural classification. He studied closely the circulation, and separated all animal life into two groups, corresponding to our vertebrates and invertebrates. One he formed of all those animals possessing red blood, in the other he placed all with a colourless fluid. His further divisions

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were into those living on the earth, in the water, and in the air. A fourth group comprised all lower forms under the name of *vermes*. With no previous researches to guide him, and but limited material to study from, he produced this accurate division which all subsequent investigations have only confirmed. For two thousand years this system was accepted. Up to the time of Linnæus, no other successful attempt was made, naturalists devoting their energies to discovering and naming species. Linnæus seeing the correctnesss of the principle adopted, did not form a new scheme, but extended his researches and made a further division into classes. (*Addendum A.*)

It is not for the system that we are indebted to Linnæus, but for the firm foundation upon which he placed the science of natural history. He it was who permanently formed the divisions of class, order, family, genus, species, and perhaps his most valuable legacy was the method of giving double names, based on the generic and specific characters—a boon few properly realize. His system was published in 1759, and for the next sixty years naturalists devoted themselves to correcting and improving upon it. The beginning of our century saw a marked advance. The Linnæan system was then discarded and that which forms the foundation of all present systems was adopted. In 1819 Cuvier gave to the world the result of his labours, which has continued with slight modification to the present day. I place with it that taught by Principal Dawson, he being our leading Canadian authority, and his system being a fair example of the many in vogue at the present day. (*Addenda B. & C.*)

Cuvier has selected the nervous structures as the means of determining his groups, at the same time giving due weight to the changes in the other vital organs. At one end he separates all possessing a brain and spinal cord extending throughout the body, and an internal skeleton, from which they derive the name vertebrata. At the other end he makes a group of all not formed on the bilateral plan, the parts radiating from a common centre, hence their name radiata. The remainder is divided into mollusca and articulata. In the former the nerve centres are scattered irregularly throughout their structure, all being connected with two chief centres situated over the throat. In the other group the nerve centres are arranged as a double chain extending the length of the

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body, a set being placed in each articulation or ring. The nervous system is not wholly considered. In the vertebrates a perfect system of respiration and circulation, the complicated digestive process, together with the number of special senses, are all distinctive characters which leave no doubt about placing this group at the head of the list. Of the relative position of the next two groups Cuvier was uncertain. They were not placed one after another, but side by side, the mollusks having a slight precedence. This he allowed, as in them he considered the circulation in closed vessels was more perfectly performed, respiration approached nearer the higher type, and the digestive organs were nearly as complex as in the vertebrates. The articulates he thought lower, as modifications in the vital processes became evident, respiration was not performed by a single organ, but by a series of chambers scattered throughout the body, and circulation and digestion were also performed on a more simple plan. Modern observers however have altered this, placing the articulates decidedly in front. Their external skeletons—the bilateral symmetry of all parts—the distinct members for locomotion, and the superior power of directing their movements, place them in a higher scale. The mollusks, on the other hand, although having greater developments of some structures, are otherwise more lowly constituted, their irregularity of structure and want of symmetry causing them to approach the radiates. The last group was easily placed at the foot of the link. Their want of special sense, their simplicity of structure and function, make it difficult to distinguish many of them from the vegetable kingdom. In the formation of classes the same general characters rule, whilst in addition certain characteristics of the group are considered. With the vertebrates, although the various functions are studied, the classes are really formed on the same plan as in the Linnæan system. The articulate classes depend on external characters chiefly. The arachnids are highest as they have pulmonary respiration; and are furnished with eight legs. Insects have head, thorax and abdomen, legs six in number. Crustaceans have their bodies divided into thorax and abdomen, and legs more numerous. Annulata are composed of numerous rings, legs rudimentary and no proper division into head, thorax or abdomen. The cephalopods are the highest of their group, having many resemblances not only to the

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articulates but also to the vertebrates. The next two classes are according to their shells. The last class consists of those constructed internally on the plan of the mollusks, but externally resembling the lower group. The radiate classes extend from the well known star fishes to the simple celled infusoria.

In deciding the scale of the natural series a certain method has always presented itself, that is, to select a certain point as a standard, compare the objects we wish to rank, and when compared, that which most nearly approaches the standard has precedence. In selecting the standard, that end of the scale is most naturally chosen which is the perfection of all types. Thus, throughout the whole animal kingdom, when we speak of a thing being highly or lowly developed, we refer to it as approaching near to or departing from the likeness of man in the construction of its parts.

Up to the time of Cuvier the idea was to form one continuous line from the highest to the lowest form of animal life. Cuvier renounced this plan, placing many of his sub-kingdoms and classes on almost equal footing. He, however, failed to explain the discrepancies or elucidate the plan of his series. This want of regularity has always perplexed classifiers who have followed the Cuvierian school. Macleay, a Scotch naturalist, attempted to arrange all in groups represented by circles, the series being continuous where the circles came in contact. The whole difficulty is due to their observation not being based upon proper theories. These systems have been formed on certain characters, without first discovering why these characters were present or ascertaining by what theory they could be explained. They failed to recognize the import of their facts and continued their investigations in the wrong direction.

At the same time that Cuvier was constructing his animal kingdom, and probably from the same influences that caused him to look deeper than his predecessors, others also commenced to investigate the subject, and although no system was evolved, the principles upon which we must build a system purely natural were discovered. All other systems were formed by studying the characteristics of the natural groups, and then bringing together all to which they could be applied. This method studies nature as a whole, from the most lowly

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formed to its highest type, and then draws the lines of demarcation, separating group from group. Adult forms are not alone considered. It follows the development of each object from its earliest condition, also enlists into its service many extinct forms, and by this means a purely natural system is created, the series being traced from the lowest to the highest creation. I have made a rough outline of the system of Haeckel, based on this method, which is given that you may obtain an insight. In these methods many points require to be proven, many obscurities to be cleared up. There is much work to be done, work which must advance slowly, but as the greater number of leading naturalists are following this plan, we can look forward to possessing, in due time, a perfect system.

Of the further division into orders, families, genera and species, the two latter are the most important, as from them the name of the object is derived. The species is the one of real value, as it is the unit of our systems. When among several individuals we find a peculiarity of form or external marking—tangible and constant—we recognize it as a specific difference, and give it a name according to some peculiar marking it possesses. When among several with such specific differences there is a general resemblance in internal structure, and often to a great extent in external characters, we recognize a natural group and name it a genus. The families and orders are very unsatisfactory, the terms giving no idea of their value. Their distinctions are some general external character which indicates a peculiarity of internal structure. Mammal orders are according to the hoof and teeth, birds according as they are made for swimming, wading, perching, etc.; insects according to the character and number of their wings. It is in these lesser divisions that we find the great differences of the many systems. Each specialist generally works independently of those in other branches; one gives a value to his divisions that another does not recognize, reducing orders and making families more numerous or increasing the number of orders and lessening the families. This constructing upon individual authority is very detrimental to the progress of science, as is also the custom of giving names by the same primitive plan. There is hardly an object that has not two or more names, and in indicating it, it is not enough to give a single authority, but it is becoming necessary to give

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he authority for both the generic and specific names. Another difficulty that is increasing to an alarming extent is that of the numerous varieties that are being recognized; so plentiful are they, that a triple name is now becoming as common as a double one.

However, as every evil works its own cure, so from this state we may hope to derive a more simple science, where one name only will be recognized and no authority required—a custom now being advocated by many American naturalists.

Hitherto the feeble state of natural history has compelled Canadian naturalists to cling to the skirts of our friends in the United States, depending solely on them as our authorities. But now with our rapid advance we require a national authority upon such matters, and it is pleasing to know that in the Geological and Natural History Survey, we have our wants supplied. During the past year, under its authority, has been issued the first part of a catalogue of Canadian plants prepared by Prof. Macoun, which must become our recognized authority. No doubt the energetic director, Doctor Selwyn, will, as researches under his direction are extended, use all endeavours to continue the publication of such aids to enquirers in all other branches of natural history.

In offering you these few remarks, my object has been to point out how very important, and what a source of gratification must be a knowledge of this nature. If I have impressed you with its value, a little study on your part will soon familiarize you with the subject. Could more of our beginners see it in this light, we should have fewer back-sliders and a host of earnest and energetic workers. In this age it is becoming fashionable to be versed in science, and numbers rush wildly after nature and think they understand what is seen. But they soon tire and wonder where the attraction lies. Others energetically learn names and make collections, but they also tire and gradually lose interest. Would they but master these principles and learn to read the book of nature, its illustrations would afford them unthought-of attractions, and ever present something new.

I would advise all who begin the study to learn the principles of nature, and I promise as their reward a rich treat—a life-long pleasure.

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Nothing is so requisite to the busy mind as relaxation, and how can it be better obtained than by retiring to her solitudes and making comparison of all the grand and beautiful things that nature has given us.

Mr. W. P. ANDERSON asked whether any analogy could be traced between the classifications of the animal and vegetable kingdoms.

The PRESIDENT said he thought not, as the classifications were formed quite independently of one another.

PROF. JOHN MACOUN was of opinion that there might be, for in plants, as in animals, there were four principal types: the thallophytes corresponding to the radiates; the acrogens and endogens to the mollusca and articulata, and the exogens to the vertebrata. To make the analogy still more marked he compared the gymnosperms, the lowest form of exogens, with the marsupials and monotremes, the lowest forms of mammalia.

ADDENDA.

A.—LINNÆUS.

DIVISION A.—Heart of 4 cavities,—2 ventricles, 2 auricles,—blood warm and red.			
	Viviparous—*Mammalia.*	Class	I
	Oviparous—*Aves*	"	II
DIVISION B.—Heart of 2 cavities,—blood red and cold.			
	Having lungs—*Amphibia.*	"	III
	Having gills—*Pisces.*	"	IV
DIVISION C.—Heart of 1 cavity,—blood white and cold.			
	Having antennæ, Undergoing transformation,—*Insecta.*	"	V
	Having tentacula, No transformation,—*Vermes.*	"	VI

B.—DAWSON.

VERTEBRATA.

Mammalia—Mammals.
Aves—Birds.
Reptilia—Reptiles.
Pisces—Fishes.

ARTICULATA.

Arachnida—Spiders and Mites.
Insecta—Insects.
Crustacea—Lobsters, etc.
Annulata—Worms.

MOLLUSCA.

Cephalopoda—Cuttle-fish.
Gasteropoda—Univalve Shells.
Lamellibranchiata—Bivalves.
Heterobranchiata—Tunicates.

RADIATA.

Echinodermata—Star-fishes.
Anthozoa—Coral animals.
Acalephæ—Jelly-fish.
Protozoa—Animalculæ, Sponges.

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C.—Cuvier.

Vertebrata.

Mammalia.
Aves.
Reptilia.
Pisces.

Mollusca.

Cephalopoda.
Pteropoda.
Gasteropoda.
Acephala.
Brachiopoda.
Cirrhopoda.

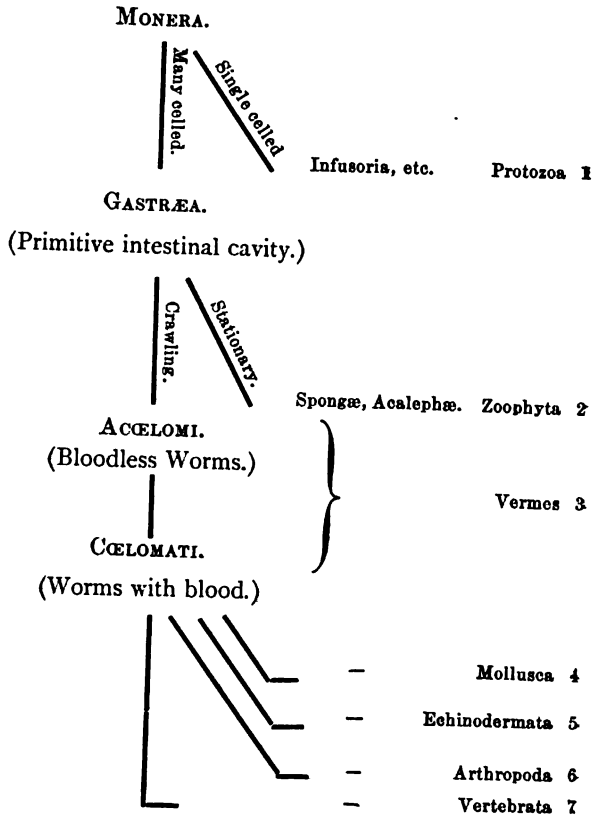
Articulata.

Annelida.
Crustacea.
Arachnida.
Insecta.

Radiata.

Echinodermata.
Entozoa.
Acalephæ.
Polypi.
Infusoria.

D.—After Haeckel.



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NOTES ON THE *FLORA OTTAWAENSIS*, WITH SPECIAL REFERENCE TO THE INTRODUCED PLANTS.

JAMES FLETCHER.

Read 20th December, 1883.

My object in preparing these notes for the Club is chiefly to explain certain points in the *Flora Ottawaensis* which might possibly be misleading to non-resident botanists.

In the drawing up of this list which was published in the first part of the Transactions there were one or two important omissions. The first of these was that there was no mention made of the limits of the locality in which the plants were collected. There is, no doubt, much room for difference of opinion as to what the limits of "this locality" should be, and it is possible that for useful work it would be better not to tie down all the branches to the same area; for instance, the extent of country which it is necessary for the Geologist to examine is far greater than that required by the Botanist, in forming a general idea of the Geology or Botany of a district, and the same may be said of the Ornithologist and Entomologist. It is not for me to make any suggestions here as to what should be the limits of any branch; nor is this a convenient time to discuss such a subject; but I will merely state that "this locality," as far as the compilation of the list of plants was concerned, has up to this time been understood to mean a distance of about 12 miles in any direction from the city, that is, about the distance a collector could travel on foot, when collecting, and return in one day. The extreme limits in different directions have included the country lying between Meech's Lake, in the Chelsea Mountains, on one side and the Mer Bleue on the other. Down the Ottawa river, East Templeton and Green's Creek have been included, and, up the river, Britannia and the islands above Aylmer. There is still a large amount of work to be done in working up the country comprised within these limits. Several districts have not been worked at all and others only visited occasionally.

Now, with regard to the list itself. A bare list of names gives no idea at all of the prevalence of any species in a locality, and this is one of the most important points the Botanist wants to know. Certain plants which are very common in some localities may be very rare here

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and *vice versa.* Then again plants natives of this country, but not indigenous in this locality, occasionally get introduced either by accident or are originally brought here as ornamental plants. These should in some way be indicated as such, or students examining the lists will be deceived. We have now published four parts of Transactions, in all of which there are lists of plants; but only in the last has any of the above necessary information been given. I hope at some future day the Club may publish a full synoptical list of the plants of this locality, giving a short account of each in the same manner that Prof. Fowler did of the plants of New Brunswick; but in the meantime it has appeared to me that by clearing up the ground as far as we have gone, and drawing attention to some of the most interesting species mentioned in the list, useful work might be done, and that is my excuse for reading to you to-night what may be to many an uninteresting and dry paper.

First of all, I regret to say there are one or two names which have been placed on the list by mistake, of these mention must be made of *Amelanchier alnifolia, Aster longifolius, A novæ-angliæ, Vaccinium vacillans, Sporobolus heterolepis,* and also *Lychnis diurna*—for *Lychnis vespertina.*

There are also one or two concerning which some doubt exists. *Anemone multifida,* D.C. A single specimen of this plant was given to me by Dr. Small, in 1877, without any data. He told me afterwards that he believed it had been found near the Rifle Range; but as it has never been re-discovered since, the record is not certain. *Trifolium agrarium,* L. This name is considered by European botanists to he a synonym of *T. procumbens,* L. *var.* My reason for saying there is some doubt about this species is that, although Prof. Macoun only mentions two forms in his new catalogue, we have in Canada apparently three distinct forms, one like each of the European varieties, and this much more robust, erect and conspicuous species, of which I have found specimens two feet in height. It is not common, but has been found several times. However, it always has the appearance of an introduced plant, and it is just possible that the change in habit may be due to climate and soil.

Polygonum dumetorum, L'Her. From a very careful examination of the descriptions of *P. dumetorum* as well as of a large series of

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specimens from different localities, I cannot satisfy myself that we have the type here, or even in Canada, at all. The variety *scandens*, Gray, has twice been found in this locality and is a much handsomer plant.

Œnothera chrysantha, Mx. I notice that Professor Macoun has included both this and *Œ. pumila*, L. in his catalogue. I have always been under the impression that these two were only varietal forms of one species dependent on the locality where they grew; *pumila* is found in wet spots by the sides of rivers or in low fields, *chrysantha* on gravelly banks and in drier places. During the past summer I have had in flower in my garden a few specimens which varied so much in appearance although grown from seed taken from the same plant but which were placed under different circumstances, that I have not yet altered my opinion. If they really be distinct *chrysantha* must be added to the Flora Ottawaensis.

The study of the introduced plants of any locality has many very attractive features; there are so many fields for speculation, and yet, at the same time, with a little study, such a large proportion of the theories can be tested. "Introduced plants" as understood in the compilation of the Flora Ottawaensis, meant those plants which, when accidentally introduced, were able to survive and mature their seeds sufficiently for these seeds to again grow and complete their cycle of existence. Of course all conspicuous and showy garden flowers which are commonly cultivated for ornament, but which occasionally occur as garden escapes, were omitted. It is not always easy to determine when a plant should be included in such a list and when not, for it must be borne in mind that by far the larger number of garden flowers are not wild flowers improved by cultivation and so changed in appearance, but wild flowers from other parts of the world only slightly, if at all, altered by climate or the habitat they are placed in. There are a great many of our common wild flowers which are grown with the greatest care in Europe, as for instance the lovely little *Anemone Hepatica* which is the first to remind us of the return of spring, or the deliciously scented May-flower (*Epigæa repens*) which under the name of Trailing Arbutus is a favourite green-house plant, also the gorgeous Ladies' Slippers (Cypripedium) with many others of the curious orchid family; and even here,

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we ourselves grow in our gardens plants from other parts of the Dominion, as the beautiful British Columbian shrubs, the flowering currant (*Ribes Sanguinea*) and Syringa, (*Philadelphus Lewisii*). These lovely shrubs, which are among the most conspicuous objects of our gardens, are found on every hillside west of the Cascades in British Columbia. From the same province, but considerably rarer, are two or three species of Rhododendron. These conspicuous plants, however, do not give the Botanist trouble, because their very beauty draws sufficient attention to them for their whole history to be known—the difficulty is with the inconspicuous plants, such as creep in uninvited and unawares among other seeds; in fact what we call weeds. But what is a weed? "The dictionaries tell us," says Dr. Gray (Am. Jl. Sc. 3 S. xviii, p. 161), "any useless or troublesome plant." "Every plant which grows in a field, other than that of which the seed has been (intentionally) sown," says the Penny Cyclopedia. The Treasury of Botany defines it "any plant which obtrusively occupies cultivated or dressed ground to the exclusion or injury of some particular crop intended to be grown. Thus even the most useful plants may become weeds if they appear out of their proper place. The term is sometimes applied to any insignificant-looking or unprofitable plants which grow profusely in a state of nature and also to any noxious or useless plant." Dr. Gray's own definition is "plants which tend to take prevalent possession of soil used for man's purposes irrespective of his will." Of course in our list of introduced plants those species are omitted which occupy ground in a state of nature, but which also as weeds conspicuously intrude into cultivated fields, as *Erigeron Canadense and Ambrosia artemisiæfolia* perhaps the most *weedy* looking plants we have. Some plants as *Trifolium repens* the white or Dutch clover, are truly useful when grown as crops, but a great nuisance when they occur as weeds. Here, as in most of the other parts of settled North America, a large proportion, in fact nearly all, of the aggressive weeds are immigrants from Europe, and it may not be amiss to consider shortly the reason of this, for it is rather remarkable that it should be the case. It is strange, too, that some which are a great nuisance here as weeds, in their own country are not at all plentiful, and the converse of this is also true; some species which in Europe are most irrepressible are here hardly able to secure a foothold,

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but unluckily these are comparatively few, and it is a notable fact that, although so many species of our common aggressive weeds have come to us from Europe, very few from this side have held their own in the old world. A partial reason for this may be that up to this time much more seed has been brought here from Europe for farms and gardens than has been sent back from this side. Dr. Gray's theory, however, is probably the correct one, and it accounts for the large proportion of the European introduced plants becoming so objectionable here. He points out that, up to a quite recent date, our whole country was covered with forests, and consequently all the indigenous plants would be forest plants. It is apparent, therefore, that for this reason they would be unsuited to live in the open spaces when cleared. On the other hand the hardy European ragamuffins used to pick up a scanty living among flag-stones and upon rubbish heaps, would grow apace when introduced into our rich virgin soil, where there were no rivals to oppose them; thus it is merely a phase of the old story—the survival of the fittest. Of course this argument would also apply to seeds accidentally taken to Europe; they would be unable to survive without the constant supply of moisture in the atmosphere which, through many generations, they had been used to in their native forest. This leads us to another theory viz.: that one so ably advocated before the Royal Society of Canada, by Prof. Macoun, to the effect that the humidity of the atmosphere is the chief element which affects the distribution of the different species of plants. Prof. Claypole (Rep. 3, Mont. Hort. Soc.) argues very elaborately, and possibly with some reason, that the types of vegetation in Europe are of a more plastic nature than those of this continent, from having had, during a long period, to live under very varying circumstances, and to adapt themselves to many different changes of habitat. In support of this theory he points out that the fossil Floras of Europe and the American of to-day, are very closely allied. He cites some very remarkable instances of Tertiary and Miocene plants, almost identical with existing American forms, and infers that the type of vegetation which we have here now, once existed in Europe as well; but from a lack of plasticity failed to survive. This theory may be partially true, but I think that the humidity of the atmosphere, namely the nature of the habitat, is the chief cause. If it were not the habitat which chiefly

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affected the existence of introduced plants in any locality, one would suppose that it was due to some quality peculiar or characteristic of the seeds themselves; and this would be, possibly, the line of thought which the mind would naturally at first entertain. Upon examination, however, we are almost startled to find that all the wonderful appendages and beautiful contrivances for the distribution of seeds, such as the copious pappus of the Compositæ, the silk of the Epilobium and Asclepias, the spinous, and hooked seeds of the Borraginaceæ, the attractive esculent fruits and mucilaginous coverings of some seeds as well as the buoyant qualities of the seeds and seedpods of certain plants, have little or no effect on the general question at large of the distribution of genera and species of plants over the surface of the globe. It is not so much a question of getting a seed to a certain locality, but of its survival when brought there. DeCandolle has worked out this idea in a masterly manner, in his "Geographie Botanique," and shows from statistics that the inherent qualities of seeds and their receptacles only apply for their distribution in the localities or countries where the plants are indigenous. He draws attention to the fact that many of the plants which apparently have the most perfect contrivances for their transmission from one place to another have an exceedingly limited range, while others with no such appendages are much more widely distributed.

The following lists give all the introduced plants which up to the present time have been found in this locality. I am of opinion that the divisions proposed will be found convenient for the botanical student. List No. 1, Aggressive Weeds, gives the names of all those plants which are so well established as to require constant attention on the part of the husbandman to keep them in check. It will be noticed that some of the names are in italics, this is meant to denote that, although the plant is introduced, it is probable that it also existed here before that time as an indigenous plant. No. 2 embraces those plants, which, having been introduced, are gradually spreading over the locality, but are not yet sufficiently numerous to have become aggressive weeds. Of these the two Erodiums and Datura Tatula are interesting examples which were first grown here as Botanical specimens in 1881, but are now to be found in waste places all over the city.

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No. 3 comprises those species, which, although well established and possibly spreading in a certain locality, are not able to spread far from that spot. Good examples of this class are found in *Rosa micrantha, Onopordon Acanthium* and *Daphne Mezereum*, which occur in single localities where there are plants, which are doubtless many years old, but which do not spread by their seeds any distance. No. 4 is made up of those plants which grow for a short time and then suddenly disappear altogether. Most of these have been introduced with seed, or have escaped from gardens; and many of them too have doubtless been introduced from Europe in seed imported as food for caged birds.

In this list the most interesting plants are *Solanum rostratum* and *Hordeum jubatum*, the former being a Colorado plant, and the latter a North Western, and both far out of their proper range. They are generally to be found in some of the streets of the city every year; but never regularly nor in the same place every year.

1. AGGRESSIVE WEEDS.

Ranunculus acris, L.
Sisymbrium officinale, Scop.
Brassica Sinapistrum, Boiss.
Capsella Bursa-pastoris, Mœnch.
Stellaria media, Smith.
Silene noctiflora, L.
Cerastium viscosum, L.
" vulgatum, L.
Portulaca oleracea, L.
Hypericum perforatum, L.
Malva rotundifolia, L.
Trifolium pratense, L.
" repens, L.
Medicago lupulina, L.
Anthemis Cotula, D. C.
Achillœa millefolium, L.
Leucanthemum vulgare, Lam.
Gnaphalium uliginosum, L.
Cirsium arvense, Scop.
" lanceolatum, Scop.
Lappa officinalis, All.
Cichorium Intybus, L.
Taraxacum Dens-Leonis, Desf.
Sonchus oleraceus, L.
" asper, Vill.
Plantago major, L.
Verbascum Thapsus, L.
Linaria vulgaris, Miller.
Nepeta Cataria, L.
Calamintha Clinopodium, Benth.
Galeopsis Tetrahit, L.
Leonurus Cardiaca, L.
Lithospermum officinale, L.
Echinospermum Lappula, Lehm.
Cynoglossum officinale, L.
Solanum nigrum, L.
Chenopodium album, L.
" hybridum, L.
Amarantus retroflexus, L.
" albus, L.
Polygonum aviculare, L.
" Persicaria, L.
" Convolvulus, L.
" *Hydropiper, L.*
Rumex Acetosella, L.
" crispus, L.
Cannabis sativa, L.
Poa compressa, L.
" *pratensis, L.*
Festuca ovina, L.
Triticum repens, L.

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Panicum glabrum. Gaudin.
" *Crus-Galli, L.*
Setaria glauca, Beauv.
" viridis, Beauv.

2. WELL ESTABLISHED AND SPREADING.

Ranunculus repens, L.
Thlaspi arvense, L.
Nasturtium officinale, R. Br.
" *amphibium, R. Br.*
Barbaraea vulgaris, R. Br.
Silene inflata, Smith.
Lychnis Githago, Lam.
Saponaria officinalis, L.
Arenaria serpyllifolia, L.
Malva moschata, L.
Linum usitatissimum, L.
Erodium cicutarium, L'Her.
" moschatum.
Trifolium hybridum, L.
Melilotus alba, Lam.
" officinalis, Willd.
Vicia Cracca, L.
Pirus aucuparia.
Potentilla argentea, L.
Sedum acre, L.
Conium maculatum, L.
Pastinaca sativa, L.
Galium verum, L.
Echinocystis lobata, T. and G. (not indig. here).
Inula Helenium, L.
Artemisia vulgaris, L.
" biennis, Willd. (not indig. here).
Lampsana communis, L.
Sonchus arvensis, L.
Veronica arvensis, L.
Mentha piperita, L.
Echium vulgare, L.
Solanum Dulcamara, L.
Nicandra physaloides, Gærtin.
Datura Stramonium, L.
" Tatula, L.
Chenopodium urbicum, L.
Rumex obtusifolius, L.
Fagopyrum esculentum, Moench.
Euphorbia Helioscopia, L.
Phleum pratense, L.
Poa annua, L.
Bromus racemosus, L.
" secalinus, L.
Triticum caninum, L.
Panicum sanguinale, L.
Phalaris Canariensis, L.

3. WELL ESTABLISHED BUT NOT SPREADING.

Berberis vulgaris, L.
Chelidonium majus, L.
Nasturtium Armoracia, Fries.
Brassica Napi.
" alba.
" campestris, L.
Raphanus raphanistrum, L.
Silene armeria, L.
Lychnis vespertina, Smith.
Saponaria Vaccaria, L.
Malva crispa, L.
Trifolium arvense, L.
" procumbens, L.
Robinia Pseudacacia, L.
" viscosa, Vent.
Vicia sativa, L.
Negundo aceroides, Moench. (not indig. here).
Rosa micrantha, Smith.
Sedum Telephium, L.
Sherardia arvensis.
Sicyos angulatus, L. (not indig. here).
Daucus carota, L.
Helianthus tuberosus, L.
" annuus, L.
Rudbeckia hirta, L. (not indig. here).
Tanacetum vulgare, L.
Artemisia absinthium, L.
Onopordom Acanthium, L.
Tragopogon pratensis, L.
Campanula rapunculoides.
Plantago lanceolata, L.
" media, L.
Verbascum Blattaria, L.
Veronica agrestis, L.

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Mentha viridis, L.
Hyssopus officinalis, L.
Nepeta Glechoma, Benth.
Symphytum officinalis, L.
Lycopsis, arvensis, L.
Convolvulus arvensis, L.
Hyoscyamus niger, L.
Nicotiana rustica, L.
Chenopodium Botrys, L.
" ambrosioides, L.
Daphne Mezereum.
Euphorbia Cyparissias, L.
Humulus Lupulus, L. (not indig. here).
Salix fragilis, L.
Populus alba, L.
" dilatata, Ait.
Asparagus officinalis, L.
Dactylis glomerata, L.
Eragrostis poæoides, Beauv.
Festuca elatior, L.
" pratensis, L.
Lolium perenne, L.
Setaria Italica, Kunth.

4. UNCERTAIN TENURE.

Papaver somniferum, L.
" Rhoeas, L.
Lepidium sativum, L.
Brassica nigra, Koch.
Camelina sativa, Crantz.
Spergula arvensis, L.
Malva sylvestris, L.
Abutilon Avicennae, Gaertn.
Hibiscus Trionum, L.
Vicia hirsuta, Koch.
" tetrasperma, Loisel.
Apium petroselinum, L.
Carum Carui, L.
Coriandrum sativum, L.
Bupleurum rotundifolium, L.
Ambrosia trifida (not indig. here).
Senecio vulgaris, L.
Centaurea Cyanus, L.
Tragopogon porrifolius, L.
Lysimachia nummularia, L.
Anagallis arvensis, L.
Satureia hortensis, L.
Calamintha nepeta, Link.
Lithospermum arvense, L.
Lamium amplexicaule, L.
Asperugo procumbens, L.
Solanum rostratum, Dunal.
Physalis Peruviana, L.
" Philadelphica, Lam.
" pubescens, L.
Blitum Bonus-Henricus, Reich.
Polygonum orientale, L.
Fagopyrum Tartaricum.
Urtica dioica, L.
Hordeum jubatum, L. (not indig. here).

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THE SAND PLAINS AND CHANGES OF WATER-LEVEL OF THE UPPER OTTAWA.

E. Odlum, M.A. (Pembroke).

Read 7th January, 1884.

By the Upper Ottawa, in this paper, is meant that portion of it which extends from the head of Coulonge Lake, a little below the lower end of Allumette Island, to the entrance of Deep River, about seven miles above the head of the same island. This takes in a stretch of nearly forty miles, following the coast line. Enough, indeed, for one attempt—too much to be very minutely handled.

By a word picture we shall hurriedly outline the position and nature of this portion of the Ottawa Valley.

a. The town of Pembroke is situated on the south side of the Upper Allumette Lake, and about twenty miles from each end of this section. This town furnishes a good point of reference.

b. The Allumette extends throughout a great part of the locality under examination.

c. The Culbute flows on the north between Allumette Island and the Quebec shore.

d. The Upper and Lower Allumette lakes separate Allumette Island from Ontario on the south.

e. At the head of the island, westward about eight miles from Pembroke, are the Narrows, where the water flows in a swift current.

f. Eastward from Pembroke, about four miles, are three rapids almost parallel, and unnavigable. These are the Allumette, Lost Chenal and Beckett's. The last is farthest south, the first farthest north, and the Lost Chenal in the centre.

g. Morrison's Island lies between the two first mentioned, and Beckett's Island between the two last.

h. At the lower end of the Allumette are Paquette's Rapids, a series of swift, but not very dangerous, currents extending about four miles from Westmeath Village to the head of Coulonge Lake. From the foot of these rapids, the Ottawa, grand, placid and majestic, glides along, joined by the Culbute, into which the Black River enters from Quebec, a couple of miles from its mouth.

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The beautiful Coulonge Lake lies spread out eastward from this point and is the eastern limit of our subject of study.

Turning our attention to the western limit, we may safely say that the scenery among the islands of the Paquette's, up the Culbute, around the Lost Chenal, through the Allumette lakes, Allumette Bay with its many islands, the Sturgeon Lake and entrance to Deep River, is as fine and enchanting as any to be seen in Canada east of the Rocky Mountains. Dr. Perkins, of Boston, accompanied the writer last summer in circumnavigating the Allumette, and passed through a large part of the district mentioned. This gentleman pronounced it as "grand and beautiful" as anything he had seen in Europe; and he had at that time travelled over most of the Continent. It has been the privilege of the writer to travel over and around our large lakes, through the prairies of the Northwest, the Thousand Islands of the St. Lawrence, the ten thousand islands of Lake Huron, to the head waters of the Ottawa, through the States of Michigan, Minnesota, Dakota and New York, over every tributary on the north shore of the mighty St. Lawrence from the head of Lake Superior to Montreal city; and, in all these glory-containing regions, the scenery of the Upper Ottawa is not surpassed and seldom equalled.

To locate more accurately we may notice that this district lies along latitude 45° 50′, longitude 76° 40′ to 77° 40′, Pembroke being 77° 10′. Height of the Upper Allumette above the sea level 400 feet. The Meteorological Station of Pembroke, under the charge of Mr. A. Thompson, is 423 feet above the sea level.

For the most part the important sand plains lie on the south side of the Ottawa. The ancient Laurentians skirt the north side of the river, scarcely retreating over a mile at any place. We may contrast the coast lines of the two provinces as follows: Ontario lies comparatively low, undulating, and quite unpretentious; but is well supported by ranges of hills farther south. Quebec, on the north, presents a rugged, massive, broken and barren appearance.

a. On the Ontario side, the Chalk River sand plain begins a little above Chalk River Station, twenty miles west of Pembroke, which town it almost reaches. There are a few broken range interruptions towards the lower end of this plain. These interruptions harmonize in

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position with the rapids, and are parts of natural barriers between a higher level westward and a lower level eastward. At places may be noticed sand ridges. These lie between ancient mouths of rivers, some of which remain to this day, as the Indian, Muskrat, and Petawawa, while others are quite extinct. Following these sand ridges mentioned, or in the direction of the diverging rivers, we invariably come gradually to higher ridges of native rock. The Chalk River Plain wants only the grass to give us a beautiful and extensive tract of prairie land, but as it is wretchedly barren sand, nothing will grow on it to any extent except ferns, small pines and blueberries, the latter in great abundance.

b. Eastward from Pembroke the sand stretches struggle with the rising and rocky bases of distant hills which skirt the Ottawa from Westmeath in the direction of Renfrew town. At last the old hills with their stores of marble get the upper hand, and the sand tracts are terminated for a time.

c. Back from the Ottawa and between Pembroke and Renfrew there is another factor to be taken into consideration. This stretch of nearly forty miles, extending beyond our present limits, is variegated with sand, clay and irregular hills of rock. One low and very even clay bed contains over 1,000 acres of good and well cultivated land. Before passing to the Qnebec side of the river a few facts may be given which will afterwards form a groundwork of some explanatory remarks.

There are many small patches of sand varying from say ten acres to a few square yards. Most of these are easily understood. The operations which are forming the smaller are going on in the presence of the observer. The larger accumulations are met with *suddenly* after passing ridges of rock in the direction of the running water, while they *gradually* disappear as we approach the next range. Wherever there is a small sand patch there is an old but weather-worn ridge of rock close at hand. Nearly always the order is this: Hard massive rock, next large angular boulders of the same, then rolling stones, after which come pebbles, then coarse, followed by fine, sand. The first is always up stream, while the others range in regular order, ending with fine sand farthest down the current. Where there are clay beds mixed

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with sand the rock ridges are generally farther away, and show a variation in their composition. Speaking carefully we may say that "clay is a soft earth which is plastic and may be moulded with the hands, consisting of alumina, to which it owes its plasticity, and also silica with water." Putting it chemically we get alumina (O_8 Al_{10}) silica ($Si\,O_2$) and water ($H_2 O$).

It results from the slow disintegration of one of the constituents of granite rocks, and when chemically pure is called alumina. The farther from the source of formation the purer is the clay, the nearer to its source the more sand is mixed up with it.

Lime, magnesia, oxide of iron and other ingredients are often present. The oxide of iron is a very common and abundant factor along the Ottawa Valley.

By careful examination the basins of ancient rivers can be easily followed, with their rapids and stretches of calm water. Even the small bays of olden times may be noted. The kinds, qualities and layers of sand must be our guide, always aided, of course, by the configuration of the immediate locality. Having referred to the qualities of sand and clay we shall now specify.

So far as soils are concerned they may be said to come from two kinds of rock, *granite* and *trap*. *Granites* consist of quartz, feldspar and mica, the latter generally an insignificant factor. Quartz is flint, or the silica of the chemist. When the granite hills and ridges are washed down by water the coarse quartz sand lies along the sides and at the immediate base of the hills, while the feldspar is ground to a fine tenacious clay and is carried forward into the valleys. Hence the soil in the flats of granite districts consists of a cold, stiff, wet and impervious clay which needs much manure, draining and labour to make it productive. The hillsides are almost useless, as they consist nearly altogether of quartz grit. Such are the Quebec slopes of the district we are now studying, but their valleys are too narrow, cramped and water hedged to give sufficient space for the sifting out of the feldspar from the quartz silt. Hence these narrow valleys are formed of ground-down feldspar and the finer quartz sand, the coarser being left along the mountain sides and close to their bases. It is on this account that the French *habitants* rejoice in their moderately fertile

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fields. In some places the writer has noticed solid bodies of feldspathic clay, but always at a distance from the rock ranges. This clay is known to many under the appellation of *pipeclay*, and is finer in texture and more coherent than marl.

Trap rocks on the other hand, consist of feldspar and hornblende. From this we see that f ldspar is common to both granite and trap. Out of 100 parts of feldspar there are 65 parts of silica, 18 of alumina and 17 of potash and soda; while of 100 parts of hornblende there are 42 parts of silica, 14 of alumina, 12 of lime, 14 of magnesia, 14 of oxide of iron. A granite soil in addition to the silicious sand consists chiefly of silica, alumina and potash, derived from the feldspar. A trap soil, in addition to the silica, alumina and potash of the feldspar contains also much lime, magnesia and iron oxide, derived from its hornblende. Hence as a hornblende soil, or more comprehensively a trap soil, contains more of the inorganic substances most important to plant composition, it is more valuable because more productive than granite soil.

There are a few fine stretches of the former, but many of the latter, along the Upper Ottawa. Using this method of comparison, we must conclude that the Upper Ottawa region will never be a first class farming country; at the very best it can only expect to be considered middling.

But we must return to our line of general observation. Large tracts containing thousands of acres, like the Chalk River Plain, are difficult to explain. The student must travel to the mountains miles away, and take in the different ranges, their bearings and the various streams and rivers which have operated during the long ages of the past. In fact it is necessary to make out the differences of water level over vast areas and the causes of the changes in the water line.

It is remarkable to see how the terraced work of Morrison's Island fits into the lower system of terraces at the mouth of Black River, where it enters the Culbute. These points are about ten miles apart. The broad Chalk River Plain corresponds in its two levels with the two definitely marked steppes standing out on the Laurentians near the head of Coulonge Lake. These two points are at least thirty miles apart. They appear to have been formed during the same water level.

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At one time, and probably within a thousand years, there was a grand and mighty lake in whose depths were hidden all the Chalk River Plain, the Pembroke district, Allumette Island, and thousands of the arable acres between Renfrew and Pembroke.

There were in fact two distinct periods, one of which represented a lake 200 feet deeper than the Upper Allumette, and the other 100 feet deeper. In passing down the Culbute, or emerging from among the islands of the Paquette's, the terraced ranges which remain as marks of old water levels show themselves quite prominently, and add much to the beauty, splendour and majesty of the scenery.

In tracing the various systems of change in the water coast line, the interest becomes intense as it is discovered, without doubt, that at one time there was a vast body of fresh water lying over the present Ottawa River, and extending in length over a hundred miles and in width from ten to thirty.

In climbing many old weather beaten and water washed rock ranges one can see clearly the holes, cauldrons and water scored channels of bygone days. At the head of Allumette Bay, into which an ancient river emptied, there are many markings left as guides for the future generations.

To aid the sceptic, who is naturally hard to convince, in understanding that the writer is not simply drawing on his imagination concerning this ancient lake with its far-reaching systems of rivers, most of which are now either wholly dried up or turned into other outlets than the Ottawa River; we shall ask him to add 200 or even 300 feet to the depth of water already indicated. In such case he will have before his vision a body of water as large or larger than Lake Superior itself.

During the summer of 1876 A. P. Coleman, Ph. D., at present Professor of Geology and Natural History in Victoria University, B. E. McKenzie, B.A., M.D., of Riverside, Toronto, F. Munson, B.Sc., and the writer had the pleasure of exploring the whole valley from Ottawa City to the head waters of the Ottawa River.

At the head of Lake Temiscamingue we noticed a magnificent range of fossiliferous limestone. It appeared to be perched on the top of the granite rock; but part of it reached into the waters of the lake

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and was lost to view. We climbed to its top, 200 feet or more from the water level, and examined it very carefully. In richest profusion and in every direction fossils of many kinds were lying. Of course this alone proves the presence of an inland sea, or a continental ocean. But the point of present interest is the fact that in every direction the operations of water may be noticed. Now if there were grinding, wearing and boring operations of water, we conclude that these took place under the action of rushing rivers.

To anyone who has a knowledge of the configuration of the Ottawa Valley the above mentioned fact is enough to prove the presence of a vast inland sea which has passed through all the necessary changes in the direction of diminution and contraction in order to leave us our present beautiful river with its islands, lakes, rapids, narrows and variegated coastings.

On the Quebec side of the river there are several interesting patches of sand ranging from 50 to 300 acres in extent, and many smaller. The most important are at Fort William, the Chapeau and Lynch's Bay. With these may be included the lower half of Allumette Island. No observer need look long for the cause of these sand beds. Every step of the formation, which is still going on in some parts, may be seen at any time that the snow is off the ground. At one time there were small rivers at many of these places, which were among the ancient feeders of the great lake system of the Ottawa Valley. These are forever gone from the face of the earth.

The Chapeau district is important from the fact that there are two distinct and prominent water lines. One of these corresponds with the second steppe at the head of the Coulonge Lake, and also with the Chalk River Plain, which is the largest within the forty miles under consideration.

The average height of the lower of these two near Chapeau is about 20 feet, and of the upper about 120. Through the upper and almost on a level with the lower, a large creek or small river meanders from among the Laurentians, and quietly loses itself in the gently flowing Culbute.

The lower part of Allumette Island is a solid mass of sand, and is on the same general plain as the lower range at the Chapeau.

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About four-fifths of the whole surface of the island and fully three-fourths of its entire length were formed by sand washed down from the mountains of Quebec, as were also many of the sand patches on the Ontario side.

Let us now look into the causes of these formations and changes. It may seem almost superfluous to make any special and minute references to the origin of these or any sand plains. But it will be of help to some if a few of the particulars are given.

Sand is finely ground rock. Mountain ranges are constantly worn down by the action of heat, frost, wind and rains of the ever-varying seasons.

It is instructive to watch closely all these agents as they do their work. Any day in the year, any hour in the day, the student may examine and learn much. To quote from notes of a trip through the mountains last July will aid us in this connection.

"We left our camp near the Chapeau, walked along the sand, among the beautiful pines on the lower level a little way back from the Culbute, and ascended the first height of 120 feet. The view thus gained was fine, and a very pleasing foretaste of what was to follow. Directing our steps towards the mountains about three miles distant, we crossed a beautiful river with wonderful embankments of sand over 100 feet high. Here we sat, observed and wondered. During perfect calmness of the air the sand kept sliding down in ten thousand almost imperceptible streams, and was hurried along by the swift waters of the river. This sand is forming a bed near and beyond the mouth of the river.

"At one place in this plateau valley there is a washout close to the point of observation. By a rough but sufficiently careful method of calculation we concluded that from 2,000,000 to 4,000,000 cubic feet of sand had been washed away from one small field. Rain begins to fall. The ascent is begun in earnest. The top of the highest peak must be reached. More than an hour is spent in climbing from crag to crag. At length we look down hundreds of feet below us on clouds and rainstorm.

"To stand on the Laurentians during a July rainstorm, and to take in all the strange and hazy grandeur, is one of the richest

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treats of a lifetime. The heavens are cleared in patches, the sun shines through the rifts, the rain falls, and rainbow-tinted glory decorates the heavens. The sight is truly grand.

"In ascending these mountains we started from their resting places large and small stones, which rolled down hundreds of feet. Boulders when displaced bounded forth with tremendous force and crashed through the trees below with irresistible violence.

"Streams caused by the falling rain were hastening down the precipices and gorges, carrying with them myriads of shining sand grains. These if examined under the microscope would be found to be granules of mica, quartz, feldspar and hornblende. On the very summit could be seen the simplest formation of these streams. Many almost invisible streams, each formed by a few drops of rain, were uniting and forming minute currents of water following the inclines and slightest indentations of the rocks. On careful examination fine grains of sand could be detected even in the spreading-out rain drops and on the bare head of the hardest and smoothest gneiss rock. In descending we reached the converging points of the smaller streams, and finally the home of the torrents furiously leaping through the deep gorges, and issuing with terrific force to join 'the brimming river.' Here we noticed something more than sand. Pebbles and small sized stones were violently borne along and deposited in the less rapid water. These are covered by the sand and soon lost to sight, but aid in filling up the valley.

"In sunshine and calm we ascended the same peaks the next day. Along the top, at the very summit, we looked carefully to see if any sand grains were left. To our great astonishment, in every direction, we found sand in quantities varying from a cubic foot to a single grain.

"Our curiosity being aroused, we examined not only the top of the bare peak, but the tops of loose boulders, and even the upper edges of small sized stones. Strange but true, this next day after a drenching rainstorm, which finished up not suddenly but very gradually, and in the warm month of July, grains of sand were lying loose on every spot which was examined.

"Another similar rainstorm would wash these grains away, and their places in turn would be occupied at once by other sparkling points.

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"On further observation we discovered a constant movement of exceedingly fine sand dust caused by the gentlest zephyrs. While descending we noticed several places where the sand was actually trickling down the crevices. Streams of sand, varying and spasmodically fluctuating, were constantly lessening the mass above and filling the hollows below.

"So far we have said but little concerning the cause of sand formation or rather rock wearing during summer weather. At any time during the warm summer months fine sand dust may be discerned even on clean-looking boulders by means of a small magnifier.

"The weather-beaten exterior of all rocks is more or less cracked and granulated. Numberless fine cracks ramify in all possible directions. Many of these are invisible to the naked eye. When the rain falls the water saturates the surface. After a little while the temperature rises. The expansion of the moisture in the cracks pries off many small grains of sand. In fact we are safe in saying that during the months of warm weather the contraction of the rock surface in the night, and the expansion consequent upon the heat of the following day, without any reference to dampness, wears away the rocks constantly."

When we remember that this section of the valley under consideration belongs to the oldest of all geological periods our interest must increase. Geologists have marked out over thirty geological divisions. Here, however, there is one, the oldest, the Archæan, of which Dana says: "There was first an age or division of time when there was no life on the globe; or if any existed this was true only in the later part of the age, and the life was probably of the very simplest kinds. The Archæan stands apart as preparatory to the age of invertebrates." Now in saying that this district belongs to only one geological period we do not mean that there has been no change during the many ages of the past. But we do mean that the rocks are Archæan with a base surrounding of their own refuse and ruins. Some would prefer to say that the first and last geological periods meet in this valley. Here the Aozoic stands out in majestic sublimity, looking down upon the only child of its many years. This could be called the Quaternary period, and, Minerva-like, came from the head rather than the loins of its pro-

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genitor. Since the latter is nothing but the ground grit of the former, it is immaterial whether we say there is a blending of two periods, or the full age and chronicled history of the Archæan alone. This history may be epitomized as follows :

a. The earth's foundation rocks were formed during the first geological period.

b. In many parts of the world the earth building went forward.

c. Various courses of material, called stratifications, have been deposited upon these foundation stones.

d. Many parts of the old formation rock were never utilized for building purposes ; as the Laurentians of the Ottawa District.

e. As they were not built upon they were left unprotected.

f. The warring elements during many cycles of time have continued to grind these foundation stones to powder, which still lies at their base in the form of sand plains.

Passing forward to another part of this subject, we acknowledge frankly that there are serious difficulties staring us in the face. The changes of the water level are necessarily linked with the different sand plains. It is absolutely essential to have different kinds of measurements for our work, such as present water depths, mountain heights and water levels as compared with the sea. The length and breadth of rivers, lakes and plains are also needed.

Anyone knows that the acquisition of all these and many other measurements involve much labour, time and expense. Few earnest students of nature are blessed with all the requisites for accurate observation concerning much of vast importance. Besides, the time marks of the Ottawa Valley are very indistinct. Their language is scarcely known as yet, and is hard to master. One kind of measurement alone is left us, and that may give us some help when acquired and used. This is *space* and lineal measurement. We venture to express an ardent wish that before many years have passed away a tabulated list of careful observations and measurements may be obtainable. In this connection we deem it quite in place to suggest that the Government establish a meteorological station at the Chapeau, and also at DesJoachims. We think, moreover, that the weather gaugers at these stations should be required to give extensive and accurate lists of actual measurements of heights and distances.

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In this paper it has been already assumed that at one time there was an extensive inland lake, which has gradually lessened till a few small lakes and river stretches alone remain. The cause of the diminution is easily seen. The water has worn down the channels at what were formerly rapids. When vast quantities of water rush annually over rock surfaces the river beds must be lowered. Observation will show that the rapids of the Upper Ottawa are natural barriers between an upper and a lower water level, and between the rapids there are even lakes or large river expansions. With a given quantity of water, a constant unit of time, and a homogeneous hardness of rock, the rate of lowering of channel must be regular unless the seasons, rains and freshets vary greatly. Even if all these were constant and regular at present, we would be unable to locate the time in the past when the mountains were 100 feet higher, or when any given river channel was 20 feet higher than now.

By an examination of the rocks we can easily perceive that the hardness varies. For example, the rock beds at the Narrows, a few miles west of Pembroke, are very hard, say seven degrees out of a possible ten. But the channel rocks of the Allumette Rapids at the opposite end of the lake from the Narrows, are only five degrees of hardness. These rocks are a fine sandstone compacted with a bluish or brown clay. The corroding action of the water tells readily upon the clay, and thus the sand grit is washed from the surface.

What do we learn from this simple fact? This: The space between the two rapids must be gradually drained of its water by the greater corrosion of the lower rapids. This means that the present Upper Allumette Lake is drying up, or draining off through the Allumette Rapids becoming lower.

This in turn means that the now navigable "Narrows" will in time become too steep and shallow for steamboats to pass. But the now unnavigable Allumette Rapids by that time will be navigable. These are changes going forward to-day, and will be facts of the future.

Again let us compare four parallel rapids, the Allumette, the Lost Chenal, Beckett's Chenal and the "High Water Portage," an old channel of the river, but now completely dry even during high water. The rocks of these four channels are all of different degrees of hardness.

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The "High Water Portage" rocks are the hardest, Beckett's Chenal next, then the Lost Chenal, and lastly the Allumette.

After examining these different channels, their positions, their volumes of water and the whole basin, we find that the volumes of water vary in inverse order, beginning with the Allumette, the largest; which means that the oldest channel has least water (it has none now), while over the soft bed of the youngest the bulk of the Ottawa rushes with a constantly increasing effect.

My attention was attracted to the "High Water Portage" by the bare and dry water-eaten rocks. The channel is as easily traced as if carrying water. The rocks are extremely hard. Beckett's Chenal shows a softening in its bed, but the Lost Chenal is more marked in this respect: clayey sandstone beginning to show itself. But when the Allumette bed is examined the conclusion must be that this channel is destined to carry all the water of the Ottawa alone. Then there will be three old and dry channels. This is an inevitable result unless the present soft Allumette channel bed is thinly built upon a hard and more enduring foundation. By this particular comparison and conclusion we are now prepared to rise to a higher plane of study. In such a system of scattering mountains as the Laurentians there are and have been many rivers. These rivers have had many mountain barriers to overcome. They have passed over the lower parts, and cut their way through the softer ridges. At one time in the past a river has rushed wildly along through a rugged and adamantine channel. Now in the later ages of the world the same river lashes itself into fury as it passes through a channel 100 feet below.

Some beautiful and clearly outlined old channels of the Ottawa are easily seen not far below Aylmer.

The Paquette's Rapids at the head of the Coulonge Lake are composed of harder rock than the bed of the Allumette. The result will be that the Upper and Lower Allumette lakes will eventually form one navigable stretch, limited at the western extremity by the "Narrows," and at the eastern by the Paquette's.

At one time the ridges back from Westmeath *connected* with the ranges on the Quebec side of the river. Over these ridges the mighty Ottawa River Lake hurled itself into a vast abyss of seething waters at

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least 200 feet below. From this fact, and also from many observations at scores of points westward along both shores and for hundreds of miles up the river we have concluded that there was once a mighty and expansive inland lake of fresh water, as previously stated.

In the interests of science and natural history this and other science associations should memorialize the Government to aid in accumulating vast stores of facts and observations. The present meteorological system is good, but needs extending and perfecting. More work needs to be performed. Not only should the general geology of Canada be studied on an extensive plan, but the ten thousand points of minutest details should be secured and placed within the reach of the earnest students of nature.

Mr. Wm. P. Anderson said he had, during the previous summer, seen the district described in Mr. Odlum's paper, and was then greatly impressed by its beautiful scenery and geological interest, and could now bear testimony to the fidelity of Mr. Odlum's graphic descriptions. He enlarged upon the nature of the sand flats at the mouth of the Petewawa and in the vicinity of Fort William, and described the granitic islands at the Narrows. He did not consider the evidence adduced by Mr. Odlum in favour of a much higher level of water by any means conclusive, as it was well known that changes of level were of constant occurrence, particularly near volcanic centres, which made it quite probable that the fossiliferous beds alluded to had been deposited at a much lower level, and raised when the Laurentians were subject to seismic disturbances; just as similar action was, even in the present day, insuring our planet against the fatal dead level so feared by Mr. Odlum.

He had also proved, by personal observation and measurements upon the sand hills of the Assiniboine Valley, that under certain conditions, the wind was so directed into currents by the inequalities of the ground as to actually drift sand up hill, and deposit it on the very tops of certain hills where different currents met and counteracted

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each other, so that it was unsafe to infer that the tops of present sand hills had at some past time been beneath the surface of the waters.*

PROF. MACOUN drew attention to the effect of sand plains upon temperature and rain fall. He had frequently noticed on the great plains of the Northwest that clouds in passing over tracts destitute of vegetation, and consequently radiating much heat were rendered invisible and dispersed, but when carried over wooded regions, again appeared and were frequently precipitated in refreshing rains.

DR. MAY (Ontario Education Department) congratulated the members on the activity of the Club. He corroborated the statements of Prof. Macoun, and made special reference to the injury continually being done to the country by the reckless devastation of the forests, which were now known to be so necessary in equalizing the water supply.

DR. R. J. WICKSTEED stated that his own observations sustained the theory advanced by Mr. Odlum as to the extent of the country once covered by the Ottawa River, or rather by the chain of lakes or expansions, at one time connected by that river. In October last, while on a lecturing tour in aid of church missions, he had spent some days in that district. The line of travel from Westmeath to Rockingham does not deviate much from a due southwest course, or one at right angles to that of the present Ottawa River. The distance between these points is, as the crow flies, about 40 miles, but by the stage route 65 miles. At Westmeath, on the Lower Allumette Lake, (an expansion of the River Ottawa) there lies to the west, the large Allumette Island, (evidently an ancient sand bar or shoal) dividing the river into two parts. To the north, and distant about six miles is seen the high Quebec shore of the river. From Westmeath to Beachburg, seven miles, the soil is light sand, deposited by the mighty river once flowing

* Mr. Anderson appears inclined to think that his reference to "the Sand Hills of the Assiniboine Valley" is sufficient to throw some doubt on my explanation concerning the sand formations. Having travelled on foot over the Assiniboine sand hills, as well as the Ottawa plains, I may state there is a marked difference. Any person who wishes to examine closely will find that the Assiniboine hills are free of stone, boulders and drift, whereas the Ottawa sand plains are well dotted with all these, showing remains of pine roots, knots and branches, cedars and various other remnants of *floated* matter. But when hills of sand are formed by wind currents, boulders and other heavy material will be absent. (Note by Mr. Odlum.)

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there. From Beachburg to Cobden, nine miles, the road descends into an old lake bottom, the lake represented by Musk Rat Lake, stiff clay soil and banks proclaiming this fact. The land rises abruptly from the lake to Cobden, and the soil becomes sandy again; but when about one mile from Cobden, the road dips again and proceeds on corduroy over clay lands and marsh bottoms, for about three miles. The line of road then commences to rise, and thence to Eganville and beyond to Rockingham the ascent is quick, and the country rugged, the habitat of those giants of the forest, the white pine and hemlock trees. His impression was that in very ancient times a mighty stream rushed over the country extending from the present Quebec shore of the Ottawa River to the neighbourhood of Eganville; and that the sand was deposited behind ripple bars formed by rocky prominences. The mud or silt was the deposite of two sluggish lake-like streams, now almost dried up and running no longer; the one represented by the Musk Rat Lake and River, and the other indicated by the Osceola River, running about three miles to the southwest of Musk Rat Lake.

Mr. W. H. Harrington having travelled up the Ottawa as far as Deux Rivières, and through the district described by Mr. Odlum was able to bear testimony to the very abundant evidences of former high water levels, as evidenced by the sand plains so well described and by the unmistakeably water-worn and sculptured rocks seen on all the portages, and along the banks of the river. In the water-scored rock bottoms of old rapids are frequently found conspicuous cylindrical holes, varying greatly in depth and diameter, which are undoubtedly due to ancient powerful currents, and which are popularly known as pot holes. These abound in the vicinity of Ottawa, at varying distances from the river, and at different elevations above its present level; sometimes forming natural wells of which settlers have availed themselves. At Deux Rivières is shown a notable one called "Noah's Churn" which is situated many feet above the river, in the rocks on the upper side of the "Devil's Portage." Although very symmetrical in shape, it is not of unusual size, being only about three and one-half feet in diameter and some eight or ten feet deep, the exact depth not being determinable on account of the hole being partially filled with earth. The name

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indicates that local tradition does not in this instance sustain the view expressed by Mr. Odlum, that these high-water levels may have existed only a thousand years ago.

LIST OF FOSSILS FROM OTTAWA AND VICINITY.

HENRY M. AMI, B.A., SECOND ASSISTANT PALÆONTOLOGIST TO THE GEOLOGICAL SURVEY OF CANADA.

Read 7th January, 1884.

INTRODUCTION.

In order to bring together in as systematic and compact a form as possible the numerous species representing the fauna of the Palæozoic and other rocks about Ottawa—heretofore scattered in the various palæontological publications of the Geological Survey of Canada, and chiefly from the pen of the late Mr. E. Billings—it has been deemed advisable to catalogue the same.

The list is a purely local one, and is intended merely as a basis for future operations in this locality.

Valuable assistance was obtained from the elaborate collections made by officers of the survey during years past, especially those of the late Messrs. E. Billings and James Richardson. Only those species which are of local interest appear in the list. The number of these has been considerably increased by the subsequent researches of Messrs. T. C. Weston, Walter R. Billings and A. H. Foord, F.G.S., as also by the evidence obtained after five seasons' collecting in this locality by the writer.

The species are classed under the respective formations to which they belong.

It has been deemed neither requisite nor even advisable to refer the species and genera to sub-orders and families, seeing that at present so much diversity of opinion exists on the subject. Only the class under which the generic and specific names appear is mentioned, and will, no doubt, prove quite sufficient for all purposes.

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There are included in the list 253 species as representing the fossil fauna and flora of our rocks. This number will evidently be swollen considerably by subsequent researches, as the measures are highly fossiliferous and the exposures extremely numerous.

Some species described and recorded by Billings and others, have been excluded from the list because the types are lost or misplaced—these it would be well to bear in mind as *desiderata*.

Several new species of Palæozoic Polyzoa, recently described by Mr. A. H. Foord, and published by the Geological Survey, are incorporated in the list.

The valuable catalogue of Palæozoic Fossils by Mr. S. A. Miller, of Cincinnati, Ohio, has been used to advantage.

CAMBRO-SILURIAN SYSTEM.

CHAZY FORMATION.

PROTOZOA.

Stromatocerium rugosum, Hall.

POLYZOA.

Prasopora Selwyni, Nicholson.

BRACHIOPODA.

Lingula Belli, Billings.
Orthis imperator, Billings.
Rhynchonella plena, Hall.

LAMELLIBRANCHIATA.

Cyrtodonta breviuscula, Billings.

GASTROPODA.

Pleurotomaria pauper, Billings.

ANNELIDA.

Serpulites dissolutus, Billings, or a very closely allied species.

CRUSTACEA.

Isotelus canalis, Conrad.
Leperditia Canadensis var. nana, Jones.

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BIRD'S EYE AND BLACK RIVER FORMATION

PROTOZOA.

Receptaculites occidentalis, Salter.
Stromatocerium rugosum, Hall.

POLYPI.

Columnaria Halli, Nicholson.
Streptelasma profundum, Hall.
Tetradium fibratum, Safford.

BRACHIOPODA.

Rhynchonella increbescens, Hall.
Streptorhynchus filitextus, Hall.

LAMELLIBRANCHIATA.

Cyrtodonta subtruncata, Hall.

GASTROPODA.

Pleurotomaria subconica, Hall.

CEPHALOPODA.

Cyrtoceras falx, Billings.
" sinuatum, Billings.
" vagans, Billings.
Gonioceras anceps, Hall.
Oncoceras constrictum, Hall.
Orthoceras (Ormoceras) Bigsbyi, Stokes.
" bilineatum, Hall.
" decrescens, Billings.
" rapax, Billings.

CRUSTACEA.

Illænus Conradi, Billings.
" ovatus, Billings.
" Trentonensis, Emmons.
Leperditia gracilis? Jones.

TRENTON FORMATION.

PLANTÆ?

Buthotrephis gracilis, Hall.
Palæophycus obscurus, Billings.
Licrophycus minor, Billings.
" Ottawaensis, Billings.
" succulens, Hall.

PROTOZOA.

Astylospongia parvula, Billings.
Pasceolus globosus, Billings.
Receptaculites Iowensis, Billings.
" occidentalis, Salter.

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POLYPI.

Diplograptus amplexicaulis? Hall.
Palæophyllum divaricans, Nicholson.
Petraia Ottawaensis, Billings.
Protarea vetusta, Hall.
Streptelasma corniculum, Hall.

CRINOIDEA.

Archæocrinus lacunosus, Billings.
" marginatus, Billings.
" microbasalis, Billings.
" pyriformis, Billings.
Calceocrinus articulosus, Billings sp.
" inæqualis, Billings sp.
Cleiocrinus magnificus, Billings.
" regius, Billings.
Dendrocrinus gregarius, Billings.
" humilis, Billings.
" proboscidiatus, Billings.
" rusticus, Billings.
" similis, Billings.
Glyptocrinus decadactylus, Hall.
" parvus, Hall.
" quinquepartitus, Billings.
" ramulosus, Billings.
Heterocrinus Canadensis, Billings.
" tenuis, Billings.
Hybocrinus conicus, Billings.
" tumidus, Billings.
Iocrinus subcrassus, Meek and Worthen.
Lecanocrinus elegans, Billings.
" lævis, Billings.
Palæocrinus angulatus, Billings.
" pulchellus, Billings.
" rhombiferus, Billings.
Porocrinus conicus, Billings.
Reteocrinus stellaris, Billings.

CYSTOIDEA.

Amygdalocystites florealis, Billings.
" " var. lævis, W. R. Billings.
" radiatus, Billings.
" tenuistriatus, Billings.
Ateleocystites Huxleyi, Billings.
Comarocystites punctatus, Billings.
Glyptocystites multiporus, Billings.
Lichenocrinus crateriformis, Hall.

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Pleurocystites elegans, Billings.
" filitextus, Billings.
" robustus, Billings.
" squamosus, Billings.

Asteroidæ.

Agelacrinites Billingsi, Chapman.
" Dicksoni, Billings.
Cyclocystoides Halli, Billings.
Edrioaster Bigsbyi, Billings.
Palasterina stellata, Billings.
Petraster rigidus, Billings.
Stenaster pulchellus, Billings.
" Salteri, Billings.
Tæniaster cylindricus, Billings.

Polyzoa.

Amplexopora discoidea, James sp.
Arthroclema pulchellum, Billings.
Batostoma Ottawaense, Foord.
Constellaria antheloidea, Hall.
" florida var. plana, Ulrich.
Diplotrypa regularis, Foord.
" Whiteavesii, Nicholson.
Heterotrypa solitaria, Ulrich.
Homotrypa similis, Foord.
Monotrypella Trentonensis, Nicholson.
Monticulipora Billingsi, Foord.
" parasitica, Ulrich.
" Westoni, Foord.
Prasopora affinis, Foord.
" oculata, Foord.
" Selwyni, Nicholson.
Ptilodictya falciformis, Nicholson.
" maculata, Ulrich.
" pavonia, d'Orbigny.
Retepora Trentonensis, Hall.
Spatiopora areolata, Foord.
Stictopora acuta, Hall.
" paupera, Ulrich.
Tetradium? Peachii, var. Canadense, Foord.

Brachiopoda.

Camerella hemiplicata, Hall.
" bisulcata, Emmons.
Discina Circe, Billings.
Leptæna sericea, Sowerby.
Lingula Philomela, Billings.

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Orthis Iphigenia, Billings.
" Merope, Billings.
" subquadrata, Hall.
" testudinaria, Dalman.
" tricenaria, Conrad.
Platystrophia biforata, Schlotheim, var. lynx, Eichwald.
Rhynchonella increbescens, Hall.
" recurvirostra, Hall.
Orthisina Verneuili, Eichwald.
Streptorhynchus filitextus, Hall.
" planumbonus, Hall.
Strophomena alternata, Conrad.
" deltoidea, Conrad.
" recta, Conrad.
" Thalia, Billings.
Trematis Ottawaensis, Billings.

LAMELLIBRANCHIATA.

Ambonychia amygdalina, Billings.
Ctenodonta gibbosa, Hall.
" levata, Hall.
" nasuta, Hall.
Modiolopsis carinata, Billings.
" Gesneri, Billings.
Pterinea Trentonensis, Conrad.

PTEROPODA.

Conularia Trentonensis, Hall.

GASTROPODA.

Bellerophon bilobatus, Sowerby.
" sulcatinus, Emmons.
Cyclonema Montrealense, Billings.
Ecculiomphalus Trentonensis, Conrad.
Murchisonia bellicincta, Hall.
" gracilis, Hall.
" Milleri, Hall.
Ophileta Ottawaensis, Billings.
Pleurotomaria Daphne, Billings.
Subulites Richardsoni, Billings.
" subfusiformis, Billings.
Trochonema umbilicatum, Hall.

CEPHALOPODA.

Endoceras proteiforme, Hall.
Orthoceras amplicameratum, Hall.
" Ottawaense, Billings.
" Python, Billings.
" vulgatum, Billings.
" Xiphias, Billings.

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ANNELIDA.

Conchicholites flexuosus, Hall.
Serpulites dissolutus, Billings.

CRUSTACEA.

Asaphus megistos, Locke.
" platycephalus, Stokes.
Bronteus lunatus, Billings.
Calymene senaria, Conrad.
Cheirurus pleurexanthemus, Green.
Dalmanites Achates, Billings.
" Bebryx, Billings.
" callicephalus, Green.
Encrinurus vigilans, Hall.
Harpes Dentoni, Billings.
" Ottawaensis, Billings.
Illænus Americanus, Billings.
" Milleri, Billings.

UTICA FORMATION.

HYDROZOA.

Didymograptus annectans, Walcott sp.
" flaccidus, Hall.
Diplograptus mucronatus? Hall.
" pristis? Hisinger.
" quadrimucronatus, Hall.
Sagenella ambigua, Walcott.

POLYZOA.

Stictopora acuta, Hall.

BRACHIOPODA.

Leptæna sericea, Sowerby.
Leptobolus insignis, Hall.
" occidentalis?, Hall.
Lingula Daphne, Billings.
" obtusa, Hall.
" Progne, Billings.
" quadrata, Eichwald.
Orthis testudinaria, Dalman.
Schizocrania filosa, Hall.
Siphonotreta Scotica, Davidson.
Strophomena alternata, Conrad.
Zygospira Headi, Billings.

LAMELLIBRANCHIATA.

Lyrodesma pulchellum, Hall.
Modiolopsis modiolaris, Hall.

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Orthodesma parallelum, Hall.
Pterinea insueta, Conrad.
" Trentonensis, Conrad.

PTEROPODA.

Conularia Hudsonia, Emmons.
" Trentonensis, Hall.

GASTROPODA.

Bellerophon bilobatus, Sowerby.
Murchisonia Milleri, Hall.
Pleurotomaria subconica, Hall.
Trocholites ammonius, Conrad.

CEPHALOPODA.

Endoceras proteiforme, Hall.
" " var. tenuistriatum, Hall.
Orthoceras amplicameratum, Hall.
" coralliferum, Hall.
" lamellosum, Hall.

ANNELIDA.

Serpulites dissolutus, Billings.

CRUSTACEA.

Asaphus Canadensis, Chapman.
" platycephalus, Stokes.
Calymene senaria, Conrad.
Cheirurus pleurexanthemus, Green.
Triarthrus Becki, Green.
" glaber, Billings.
" spinosus, Billings.
Leperditia cylindrica, Hall.

POST-TERTIARY.

LEDA CLAY AND SAXICAVA SAND.

PLANTÆ.

Fucus sp.
Populus balsamifera, Linnæus.
Potamogeton sp.
Potentilla Canadensis, Linnæus.

LAMELLIBRANCHIATA.

Macoma fragilis, Fabricius.
Mytilus edulis, Linnæus.
Portlandia arctica, Gray.
Saxicava rugosa, Linnæus.

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PISCES.

Cyclopterus lumpus, Linnæus.
Mallotus villosus, Cuvier.

CETACEA.

Phoca Grœnlandica.

ALLUVIUM (SHELL-MARL DEPOSIT.)

GASTROPODA.

Amnicola porata, Say.
Conulus fulvus, Draparnaud.
Hyalina arborea, Say.
" indentata, Say.
Limnæa desidiosa? Say.
" galbana, Binney.
" stagnalis, Linnæus.
Mesodon albolabris, Say.
" " var. dentifera, Binney.
" Sayii, Binney.
Patula alternata, Say.
Physa heterostropha, Say.
Planorbis bicarinatus, Say.
" campanulatus, Say.
" parvus, Say.
Valvata tricarinata, Say.

EDIBLE AND POISONOUS FUNGI.

PROF. JOHN MACOUN, M.A., F.L.S., F.R.S.C., BOTANIST TO THE GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

Read 31st January 1884.

The title of my paper needs but little explanation, as I only apply it to those fungi which by common consent are admitted to be edible or suspicious or poisonous. These may be found in abundance in our woods and fields, or by our roadsides at various times during the summer.

I may say with truth that Canadian fungi are almost unknown as regards their numbers, their value as food or their injurious effects on the human system. It is therefore with some diffidence that I approach a subject which to me is less familiar than any other branch of

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the vegetable kingdom, and which possibly to you may have no interest whatever. For myself, I entered on their study at the suggestion of my chief, Dr. Selwyn, Director of the Geological and Natural History Survey, and now, when I stand only at the portal of the vast unexplored region beyond, I ask your attention to a few of the facts already gleaned, and hope they may not be altogether without interest, and even profit.

At present the greater number of systematic botanists recognize five great divisions or classes in the vegetable kingdom, of which the fifth or lowest is named thallogens or thallophytes, because organisms of this class instead of growing upright expand into a thallus consisting of parenchyma alone, and never exhibiting a marked distinction into root, stem and foliage. All plants of this class are flowerless. This class includes five orders, viz.:

LICHENS.

FUNGI.

ALGÆ.

DESMIDIACEÆ, single cells of a green colour, found in fresh water.

DIATOMACEÆ, single cells of brown colour, and having silicious cell walls, found in sea and fresh water.

The plants in the first order, lichens, are never aquatic, but grow on bark of trees, earth or rock, and draw their nourishment from the air. Fungi, on the other hand, are parasitic, and live by appropriating the juices of living plants to their own use or the organized matter of dead and decaying animal or vegetable. Algæ are almost strictly aquatic, the greater number of them being seaweeds. You will note that these three orders, although quite closely related, are kept apart by their special modes of obtaining nourishment, and that the fungi always use prepared food even if by so doing they destroy that which man has laid up for himself. Those species which produce rust, smut, mildew and many other plant diseases are parasitic and prey exclusively on living plants, while mushrooms (agarics) and puff-balls live on dead and decaying matter.

As the purpose of this paper is not to give the classifications of the order, I shall pass at once to the section named the Agaricini, as it

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is to this division that the greater number of the toadstools and mushrooms of our woods and fields belong, and to these I will at once direct your attention.

We mentioned that fungi had no flowers, and in this division as well as in all others they begin by the production of filamentous threads or attenuated cells which appear like the roots of the fungus which afterwards appears. These threads are called the mycelium, and are the true vegetation of the fungi. What are denominated fungi are therefore the *fruit* and not the *whole* plant, as many believe. Agarics or mushrooms are merely rounded tubercles which are formed on the mycelium below the surface. Some of these rapidly enlarge, burst through an outer covering (called the volva or wrapper), which is left at the base, thrust out a stalk or stipe bearing at its top a rounded body—the pileus, or cap. Underneath this cap are the lamellæ or gills that occupy the whole lower surface, and which consist of a series of plates which bear over their whole surface naked sporules, which on examination under a microscope will be found grouped in fours.

The drawing before you is that of the Fly Amanita (*Amanita muscaria*), one of the most beautiful and widely distributed as well as most dangerous and highly organized of our agarics. This species is commonly found in the depths of the forest, generally under firs or pines, and in the months of June and July is a very conspicuous object in the northern woods. Last June it was a lovely sight in the woods of Nova Scotia near Annapolis. The specimen before you, with many others, was obtained in Rideau Hall woods by Mrs. Chamberlin. In the North of England and Scottish Highlands it is a most lovely object in the dark fir woods, and its crimson pileus when lighted up by a sunbeam falling aslant through the thick foliage is a sight never to be forgotten.

In Northeastern Asia this species is a favourite drug to produce intoxication amongst the Russians and natives of Kamtschatka. The fungi are collected in the hottest month and hung up to dry. When taken to produce intoxication small pieces are rolled up and swallowed without chewing.

Our next drawing is that of the edible mushroom (*Agaricus campestris*), which is so well known that its praises need not be

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recited. There are numerous varieties of it in fields and gardens and along our roadsides, but were its value as an article of food better known it would be extensively cultivated and largely take the place of meat on our tables, as it contains nearly as much nutrition, pound for pound, as our best beefsteak. At present only a few of its forms are gathered, and large quantities go to decay through ignorance of their value.

The next figure is a life-like representation of the tall cylindrical agaric (*Coprinus comatus*), which is another common and esculent species. In the latter part of last September this species was a very prominent object on many lawns in the western part of the city, growing in groups or singly, and often throwing up stems nearly a foot high. No one seemed to touch it, and bushels of them went to waste for want of collectors. This species is highly nutritious and quite as palatable as the mushroom, and is apparently better suited for catsup, as it contains a great deal of juice, and if allowed to become old soon melts away. In passing to decay, like all the genus (coprinus), it dissolves into a black fluid. Rhind says: "If this be collected and boiled with a little water, and a few cloves added to prevent it getting mouldy in keeping, and passed through a filter, it furnishes an excellent bistre for painting."

Numerous other species of agarics might be cited and dwelt upon, but time will not permit of anything but a passing notice, which I can best do by explaining these beautiful drawings furnished by "our artist," whom I am happy to see amongst us to-night.

(A collection of water colour paintings by Mrs. Chamberlin was here exhibited.)

Another section of this vast family is represented by the morel (*Morchella esculenta*), which differs from the agaric in having, in common with all the lower forms of fungi, their whole interior, though often of a very large size, filled with a multitude of *asci* (elongated sacs), enclosing single or double sporules such as are found in lichens. This fact has caused some late writers to claim a closer connection between fungi and lichens than I am able with my limited knowledge to perceive.

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Our representative of the morel is before you, but those that are acquainted with the true species will observe that this form has an undulated, irregular, gyrose pileus, while the true species has an ovate pileus with firm ribs surrounding deep pits. In colour this species is browner, and as an article of food not so pleasant to the taste. This form is named *Gyromitra esculenta*, or the edible gyromitra, while the morel is named *Morchella esculenta*. Early in spring this species may be found in some profusion in most woods in the vicinity of the city, and was particularly abundant in the woods at the back of Rideau Hall last May and June. Besides these, I have gathered two species of helvella at Belleville, both of which are esculent. Closely related to these are the truffle family, which are of such economic importance in the South of Europe, but of which we have no representatives.

There is still another section which claims more than a passing notice. I mean the puff-balls. These forms, which are included in the genus lycoperdon, are, according to Professor Peck, all esculent when gathered young and cooked before the spores turn yellow. One species, *Lycoperdon giganteum*, grows to an enormous size, and specimens are on record which were over three feet in diameter. Professor Peck mentions one that was a little over eight feet in circumference and weighed 47 lbs. He says it looked at a distance like a small boulder, and would make a meal for a good sized family. One writer recommends that when one of these large ones is found only a part of it should be taken —enough for a meal—and another part next day, and so on. In this way one of them might serve a family for a week. It is said that when the growing plant is wounded the wounds heal and are filled up with new tissue.

Another species, the cup-shaped puff-ball, is very abundant on our western prairies, forming great rings with the edible mushroom. In summer of 1879, when exploring on the plains northwest of Qu'Appelle, we came upon multitudes of this species, ranging in size from a man's fist to his head, and the same species was gathered in thousands north of the Cyprus Hills and west of Strong Current Creek. Mushrooms being in myriads, we did not eat many messes of puff-balls, for when a man ate a mallard and about half a peck of mushrooms at a sitting he had quite sufficient for one meal. * * * * *

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Mr. FLETCHER was surprised to hear that the fly agaric, as figured before the meeting, was identical with the European species, which, instead of having the pileus of a yellowish brown colour, has one of a most intense scarlet. He mentioned as a curious fact that in Italy, where fungi form a large portion of the food, the State Inspector of Fungi condemns the *Agaricus campestris* as unwholesome on account of the large number of edible species superior to it.

Mrs. TRAILL, of Lakefield, Ont., so long known in Canada as a writer on natural history, expressed her pleasure at having had an opportunity of attending the meeting, and had collected in Central Ontario many of the species depicted in the plates shown.

LIST OF OTTAWA COLEOPTERA.

W. HAGUE HARRINGTON.

Read 14th February, 1884.

INTRODUCTION.

Having by request of the Council prepared for publication a list of Ottawa Coleoptera, it is almost imperative that it should be introduced by a brief paper, showing under what conditions it appears. Although it should only be considered as preparatory to a more extended and perfect list, to be issued when a fuller knowledge of our fauna has been gained, it will serve as a basis on which to build in the future, and may, I hope, be found not without a present value. The difficulties encountered in its preparation have been great, but the result brings with it a reward in that much necessary work has now been completed and that future progress will be the more readily made.

The classification followed in the list is that of Drs. LeConte and Horn, published last year by the Smithsonian Institute, and the arrangement of the families therefore differs from that of other Canadian lists. Under this classification the coleoptera of North America are divided into eighty-three families, of which we have represented so

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far sixty-seven. The number of named species in my list is 926,* but more than 200 species are yet undetermined, so that the total number of species which have been taken is about 1,150.

Every possible precaution has been taken to guard against errors such as have unfortunately greatly lessened the value of some recent Canadian lists. A large proportion of my elateridæ, buprestidæ, cerambycidæ and chrysomelidæ were named for me by the late Dr. LeConte, and I am indebted to Mr. John B. Smith† for abundant help in the determination of species in other families. Without the assistance so generously given by these gentlemen it would indeed have been impossible for me yet to prepare my list.

The principal value of a local list, other than as a mere catalogue of a collection, is due to the information it affords as to the geographical distribution of species. The consideration of this question must, however, be postponed until it has received the careful attention it so richly deserves. Meanwhile I have made a rough general comparison of our fauna with such lists as I have in my possession, with a view to finding which groups are most fully, or most meagrely represented, and of gaining an idea as to the total number of species likely to occur here.

Six lists have been used in this comparison. First, a list published by Mr. Pettit (Can. Ent., vols. II and III), of 1,143 species taken at Grimsby, Ont. Second, a list by Messrs. Reinecke and Zesch of about 1,400 species captured in the vicinity of Buffalo. Third, a list published by Mr. Couper (Can. Sport. and Nat.) of 1,012 species recorded from the Province of Quebec. Fourth, a list by Messrs. Hubbard and Schwarz of 1,246 species recorded from the Lake Superior region. Fifth, a list by the same authors of 1,787 from the lower peninsula of Michigan. Sixth, one by Mr. Schwarz of 1,457 species captured in Florida. The three last were published in Vol. XVII of the Proceedings of the American Philosophical Society, and were very kindly sent to me by Dr. LeConte only a few weeks before his lamented death.

All these lists contain more species than that which I have prepared, but the reason in each case is not difficult to determine. Com-

* Increased by further determinations to 1,003.
† Now a corresponding member of the Club.

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mencing with the Quebec list, it must be remembered that it is for the whole Province, and that it includes all species recorded therefrom. Nominally it contains 1,012 species, but many of the names are merely synonyms for, or varieties of, other species. The Lake Superior and Michigan lists include all species then known from these extensive districts, while that of Florida deals with a very large and varied country having a particularly rich flora and fauna. The only really local lists are those of Grimsby and Buffalo. I do not know how long Mr. Pettit collected at the former place, but from the extent of his list and from his reputation as a coleopterist it is probable that he was working for many years. The Buffalo list is the result, as stated by the authors, of the labour of seventeen years, during which period all their leisure hours were exclusively devoted to the accumulation and study of the species occurring in their vicinity.

Our Ottawa coleoptera have (with the exception of a few species secured at Club excursions) been collected within a radius of ten or twelve miles, and nearly all the species have been taken since the formation of the Club, or within the past six years. I am indebted to Mr. James Fletcher for a number of species, and to Mr. A. W. Hanham, a former member, for several, while a few specimens have been received from other members.

The few families to which special attention has been given in collecting are found by comparison with the above lists to be very well represented, but in many families the number of species is very small. Carabidæ, for instance, are represented in the Grimsby list by 156 species, Lake Superior 202, Michigan 204 and Buffalo 186, while we have as yet only 114. Again, the water-beetles—dytiscidæ, gyrinidæ and hydrophilidæ—are: Grimsby 80 species, Lake Superior 119, Michigan 104, Buffalo 77 and Ottawa only 65. As water beetles are apparently as numerous in these latitudes as they are farther south (the Florida list gives only 60 or 65 species), we should have very many more species on our list. If 119 species occur at Lake Superior, the fauna of which most closely resembles ours, there seems to be no reason why our list should not contain at least 100, when our rivers, lakes and other waters are examined with any degree of care.

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Many other large groups have also been almost entirely neglected, and will yield, when properly investigated, many additional species. If there were a few more collectors the different localities could be properly examined, and the list of Ottawa species carried within a year or two to probably fifteen hundred, and eventually to fully two thousand.

Until more of my species are determined it would be almost useless to make any general comparison of our fauna with that of other districts, but I have tabulated three families in which the species are fully determined, with the following results. Of elateridæ we have more species than are enumerated in any of the previously mentioned lists, with the exception of the Quebec one, which has an equal number, viz., 89. The others have respectively, Grimsby 77, Lake Superior 82, Michigan 80, Buffalo 74, and Florida 52. Of the latter species only nine, or seventeen per cent., have occurred here. Three of these *(Alaus occulatus, A. myops* and *Melanotus communis)* are common to all the lists, while one *(Fornax badius)* is unrecorded in any of the others. Of Grimsby species we have 51, Lake Superior 51, Michigan 48, Buffalo 48, and Quebec 58, or sixty-five per cent. That our fauna is essentially a northern one is shown not only by the absence of the Florida species, but from the fact that of 40 species contained in a list of Green Mountain coleoptera (R. Hayward and H. Savage, Quart. Journal Boston Zoölogical Soc.) we have 29, or seventy-five per cent.

In buprestidæ the species enumerated are as follows: Ottawa 37, Grimsby 35, Lake Superior 30, Michigan (which alone exceeds Ottawa) 38, Quebec 28, Buffalo 34, and Florida 29. From the Green Mountains seven species are given, of which we have all. Of the species from the former localities we have from sixty to sixty-five per cent., except of the Florida species, only seven of which, or about twenty-four per cent., occur here. Of these seven species two are the common injurious insects known as the apple tree borer *(Chrysobothris femorata)* and the raspberry borer *(Agrilus ruficollis)*.

Of cerambycidæ there are in the Ottawa list 106 species, Grimsby 103, Lake Superior 78, Michigan 86, Buffalo 138, Quebec 111, and Florida 76. We have 60 per cent. of Buffalo species, 63 per cent. of Grimsby, 65 per cent. of Quebec, 68 per cent. of Michigan, and 73 per

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cent. of Lake Superior, but only 13 per cent. or ten species of the Florida list. Of 32 Green Mountain species we have 24, or seventy-five per cent. Only two species are common to all the lists, viz., *Xylotrechus colonus* and *Urographis fasciatus*.

Adding together the three families we have just considered, the totals are: Ottawa 231 species, Florida 157, Lake Superior 190, Michigan 204, Grimsby 215, Quebec 228, and Buffalo 246, or fifteen more than Ottawa. This comparison clearly shows that, were all the other families fully worked up, our collections would be very largely increased.

Although my list contains many species not previously recorded from Canada, it is yet doubtful whether any species new to science have been captured. When Dr. LeConte was here last summer he took home with him a box of rare species and afterward sent me a partial list in which three new species† were indicated. Unfortunately these species, as well as the unnamed remainder, have been probably sorted into his vast collections, and are thus lost to us, although luckily not lost to science.

There are many rare and interesting species worthy of special mention, but for want of time such consideration must be deferred.

Species, one hundred and ten in number, marked with an asterisk (*), have apparently not been previously included in lists of Canadian coleoptera.

OTTAWA COLEOPTERA.

CICINDELIDÆ.

Cicindela longilabris, Say.
6-guttata, Fab.
purpurea, Oliv.
var. limbalis, Kl.
vulgaris, Say.
12-guttata, Dej.
repanda, Dej.

CARABIDÆ.

Omophron americanum, Dej.
Cychrus Lecontei, Dej.
Calosoma frigidum, Kirby.
calidum, Fabr.
Elaphrus Clairvillei, Kirby.
cicatricosus, Lec.
ruscarius, Say.
Blethisa quadricollis, Hald.
Dyschirius nigripes, Lec.
globulosus, Say.
hispidus, Lec.*
sp.
Clivina americana, Dej.*
Nomius pygmæus, Dej.

† Dr. Horn has since determined one of these to be *Malachius Ulkei*, Horn.

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Bembidium inæquale, Say.
nitidum, Kirby.
americanum, Dej.
nigrum, Say.
planum, Hald.
bimaculatum, Kirby.
rupestre, Dej.
dorsale, Say.
intermedius, Kirby.
pictum, Lec.
4-maculatum, Linn.
several unnamed species.
Tachys flavicauda, Say.
nanus, Gyll.
incurvus, Say.
sp.
Patrobus longicornis, Say.
Pterostichus adoxus, Say.
dilligendus Chd.*
coracinus Newm.
stygicus, Say.
lucublandus, Say.
luctuosus, Dej.
corvinus, Dej.
mutus, Say.
orinomum, Leach.
erythopus, Dej.
femoralis, Kirby.
mandibularis, Kirby.
Lophoglossus scrutator, Lec.
Amara avida, Say.
exarata, Dej.*
angustata, Say.
impuncticolis, Say.
polita, Lec.*
obesa, Say.
Diplochila impressicollis, Dej.
Badister notatus, Hald.
pulchellus, Lec.
Calathus gregarius, Say.
impunctata, Say.
Platynus sinuatus, Dej.
extensicollis, Say.
decorus, Say.
anchomenoides, Rand.
melanarius, Dej.
propinquus, Gemm.*
cupripennis, Say.
var. nitidulum, Dej.
excavatus, Dej.
picticornis, Newm.
ruficornis, Lec.
lutulentus, Lec.
8-punctatus, Fabr.
placidus, Say.
obsoletus, Say.
quadripunctatus, Dej.
Olisthopus micans, Lec.
Anchus pusillus, Lec.
Lebia grandis, Hentz.
tricolor, Say.
viridis, Say.
pumila, Dej.
ornata, Say.
furcata, Lec.
Metabletus americanus, Dej.
Callida punctata, Lec.
Cymindis pilosa, Say.
borealis, Lec.*
Brachynus americanus, Lec.
perplexus, Dej.
medius, Harris.
alternans, Dej.
fumans, Fabr.
Chlænius tomentosus, Say.
niger, Rand.
impunctifrons, Say.
tricolor, Dej.
solitarius, Say.
sericeus, Forst.
Anomoglossus emarginatus, Say.
Brachylobus lithophilus, Say.
Agonoderus pallipes, Fabr.
partiarius, Say.
Harpalus erraticus, Say.
viridiæneus, Beauv.
caliginosus, Fabr.
pennsylvanicus, Dej.
herbivagus, Say.
laticeps, Lec.
basilaris, Kirby.
Stenolophus conjunctus, Say.
dissimilis, Dej.
ochropezus, Say.

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carus, Lec.
Bradycellus vulpeculus, Say.
ruprestris, Say.
Anisodactylus rusticus, Dej.
nigrita, Dej.
discoideus, Dej.
baltimorensis, Say.
(*Xestonotus*) lugubris, Dej.
(*Amphasia*) interstitialis, Say.
(*Spongopus*) verticalis, Lec.

HALIPLIDÆ.

Haliplus triopsis, Say.
ruficollis, Dej.
Cnemidotus 12-punctatus, Say.

DYTISCIDÆ.

Laccophilus maculosus, Germ.
Hydroporus, inæqualis, Fabr.
hybridus, Aubé.*
affinis, Say.
rotundatus, Lec.
consimilis, Lec.
spurius, Lec.
modestus, Aubé
dichrous, Mels.*
americanus, Aubé?*
signatus, Mannh.
tristis, Payk.
notabilis, Sharp.*
sp. near persimilis, Cr.
three unnamed species.
Coptotomus interrogatus, Fabr.
Ilybiosoma bifarius, Kirby.
Agabus, sp.
aeneolus, Cr.
stagninus, Say.
punctulatus, Aubé.
Rhantus binotatus, Harris.
Colymbetes sculptilis, Harris.
longulus, Lec.
Dytiscus Harrisii, Kirby.
fasciventris, Say.
Cordieri, Aubé.
Acilius fraternus, Harris.

GYRINIDÆ.

Dineutes assimilis, Aubé.
Gyrinus borealis, Aubé.
two unnamed species.

HYDROPHILDÆ.

Helophorus lacustris, Lec.
obscurus, Lec. *var.**
lineatus, Say.
tuberculatus, Gyll.
Hydrochus rufipes, Mels.*
Hydraena pennsylvanica, Kiesw.
Hydrophilus glaber, Hb.
Ochthebius sp.
Hydrocharis obtusatus, Say.
Berosus striatus, Say.
Philhydrus cinctus, Say.
diffusus, Lec.
perplexus, Lec.
sp.
Hydrocombus lacustris, Lec.
rotundatus, Say.
Hydrobius fuscipes, Linn.
feminalis, Lec.*
subcupreus, Say.
Cercyon prætextatum, Say.
pygmæum, Ill.*
unipunctatum, Linn.
several unnamed species.
Cryptopleurum vagans, Lec.

SILPHIDÆ.

Necrophorus pustulata, Hersch.
orbicollis, Say.
tomentosa, Web.
Silpha surinamensis, Fab.
lapponica, Hb.
noveboracensis, Forst.
inæqualis, Fab.
americana, Linn.
Choleva terminans, Lec.
Prionochæta opaca, Lec.
Hydnobius, substriatus, Lec.*
Anisotoma punctostriatus, Kirby.

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Liodes globosa, Lec.
geminata, Horn.*
sp.
Agathidium oniscoides, Beauv.
revolvens, Lec.
sp.

SCYDMÆNIDÆ.

Scydmænus fossiger, Lec.
basilis, Lec.
fatuus, Lec.
n. sp.

PSELAPHIDÆ.

Ctenistes piceus, Lec.
Tyrus humeralis, Aubé.
Pselaphus Erichsonii, Lec.
Tychus longipalpus, Lec.
Bryaxis conjuncta, Lec.
Brendelii, Horn.*
puncticollis, Lec.*
propinqua, Lec.
rubicunda, Aubé.
tomentosa, Lec.*
Decarthron abnorme, Lec.
formiceti, Lec.
Batrisus globosus, Lec.

STAPHYLINIDÆ.

Falagria venustula, Er.
Homalota lividipennis, Mann.
sp.
Tachyusa, species unnamed.
Aleochara lata, Grav.
gracilicornis, Fauvel, MSS.*
Oxypoda tenebrosa, Fauvel.
sp.
Gyrophæna corruscula, Er.*
Quedius molochinus, Grav.
sp.
Listotrophus cingulatus, Grav.
Creophilus maxillosus, Linn.
Staphilinus vulpinus, Nordm.
cinnamopterus Grav.
violaceus, Grav.
cæsareus, Cederh.
Ocypus ater, Grav.
Philonthus cyanipennis, Fabr.
aeneus, Rossi.
niger, Mels.*
debilis, Grav.
palliatus, Grav.
micans, Grav.
brunneus, Grav.
lætulus, Say.*
agilis (?)*
quadricollis, Fauvel MSS.
varicolor, Boh.
Xantholinus cephalus, Say.
hamatus, Say.
Diochus Schaumii, Kraatz.
Dianous cœrulescens, Gyll.*
Stenus juno, Fabr.
flavicornis, Er.
several unnamed species.
Euæstethus americanus, Er.
Cryptobium bicolor, Grav.
pallipes, Grav.
Lathrobium grande, Lec.
collare, Er.
rubripenne, Fauvel.*
Stilicus sp.
Lithocaris confluens, Say.
Pæderus littorarius, Er.
Sunius longiusculus, Mann.
Tachinus luridus, Er.
flavipennis, Dej.
Tachyporus jocosus, Say.
brunneus, Fabr.
Erchomus ventriculus, Er.
Conosoma crassum, Grav.
basale, Er.
Bolitobius niger, Grav.
cinctus Grav.
intrusus, Horn.
sp.
Bryoporus rufescens, Lec.
cribratus Fauvel.*
Mycetoporus lepidus, Grav.*
americanus, Er.
Oxyporus rufipennis, Lec.
femoralis, Grav.
Bledius semiferrugineus, Lec.

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Trogophlœus nitellus, Fauvel.*
Geodromicus nigrita, Mull.*
Homalium sp.
Anthobium sp.
Micropeplus tesserula, Curt.

TRICHOPTERYGIDÆ.

Ptenidium evanescens, Msh.*
Nephanes læviusculus, Matth.*
Trichopteryx sp.

SCAPHIDIIDÆ.

Scaphidium 4-guttatum, Say.
Scaphisoma convexum, Say.
Taxidium gammaroides, Lec.

PHALACRIDÆ.

Phalacrus politus, Mels.
Olibrus consimilis, Msh.
sp.

CORYLOPHIDÆ.

Sacium lugubre, Lec.
sp.
Corylophus marginicollis, Lec.

COCCINELLIDÆ.

Megilla maculata, DeG.
Hippodamia 5-signata, Kirby.
convergens, Guér.
13-punctata, Linn.
parenthesis, Say.
Coccinella trifasciata, Linn.
9-notata, Herbst.
5-notata, Kirby.
monticola, Muls.
sanguinea, Linn.
Adalia frigida, Schn.
vipunctata, Linn.
Harmonia picta, Rand.
Anatis 15-punctata, Oliv.
Psyllobora 20-maculata, Say.
Chilocorus bivulnerus, Muls.
Brachyacantha ursina, Fabr.
var. 10-pustulata, Mels.
Hyperaspis signata, Oliv.
proba, Say.
bigeminata, Rand.*
undulata, Say.
Scymnus fraternus, Lec. ?*
hæmorrhous, Lec.
punctatus, Mels.
sp.

ENDOMYCHIDÆ.

Lycoperdina ferruginea, Lec.
Mycetina perpulchra, Newm.
vittata, Fabr.
Endomychus biguttatus, Say.

EROTYLIDÆ.

Languria gracilis, Newm, *var.*
Dacne 4-maculata, Say.
Megalodacne heros, Say.
Mycotretus pulchra, Say.
sanguinipennis, Say.
Triplax thoracica, Say.

COLYDIIDÆ.

Synchita fuliginosa, Mels.
Cicones marginalis, Mels.
Ditoma quadriguttata, Say.
Cerylon castaneum, Say.
Philothermus glabriculus, Lec.

CUCUJIDÆ.

Silvanus planatus, Germ.
bidentatus, Fabr.
Catogenus rufus, Fabr.
Cucujus clavipes, Fabr.
Pediacus fuscus, Er.
Læmophlœus biguttatus, Say.
convexulus, Lec.*
Dendrophagus glaber, Lec.
Brontes dubius, Fabr.

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Cryptophagidæ.

Telmatophilus americanus, Lec.
Antherophagus ochraceus, Lec.
  convexulus, Lec.
Paramecosoma serrata, Gyll.
Cryptophagus, sp.
Atomaria ephippiata, Zimm.
  several unnamed species.

Mycetophagidæ.

Mycetophagus punctatus, Say.
  flexuosus, Say.
  bipustulatus, Mels.
  pluripunctatus, Lec.
  obsoletus Mels.
  sp.
Triphyllus humeralis, Kirby.
Litargus tetraspilotus, Lec.
Typhœa fumata, Linn.

Dermestidæ.

Byturus unicolor, Say.
Dermestes nubilus, Say.
  lardarius, Linn.
  bicolor, Fabr.*
Attagenus megatoma, Fabr.
Anthrenus varius, Fabr.
  musæorum, Linn.
Cryptorhopalum ruficorne.*
Orphilus ater, Er.
  glabratus, Er.* *var.*

Histeridæ.

Hister Harrisii, Kirby.
  interruptus, Beauv.
  abbreviatus, Fabr.
  defectus, Lec.*
  16-striatus, Say.
  americanus, Payk.
  exaratus, Lec.*
  carolinus, Payk.
  Lecontei, Mars.
  parallelus, Say.
  coarctatus, Lec.
  cylindricus, Payk.
  sp.
Saprinus fraternus, Say.
Teretrius americanus, Lec.

Nitidulidæ.

Brachypterus urticæ, Fabr.
Carpophilus niger, Say.
  brachypterus, Say.
Colastus truncatus, Rand.
Epuræa æstiva, Linn.
  rufa, Say.
  truncatella, Mann.
  sp.
Nitidula bipustulata, Fabr.
  rufipes, Linn.
  ziczac, Say.
Phenolia grossa, Fabr.
Omosita colon, Linn.
Ips fasciatus, Oliv.
  var. 4-signatus, Say.
  sanguinolentus, Oliv.
  confluens, Say.
  vittata, Say.
Rhizophagus remotus, Lec.

Trogositidæ.

Trogosita mauritanica, Linn.
  dubia, Horn.
  sp.
Peltis ferruginea, Linn.
Calitys scabra, Thunb.
Grynocharis 4-lineata, Mels.
Thymalus fulgidus, Er.

Lathridiidæ.

Stephostethus liratus, Lec.
Lathridius, species unnamed.
Corticaria pumilus, Mels.
  species unnamed.

Byrrhidæ.

Clytilus varius, Fabr.
Byrrhus americanus, Lec.

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Pettitii, Horn.
Syncalypta echinata, Lec.*
Limnichus punctatus, Lec.

PARNIDÆ.

Psephenus Lecontei, Hald.
Stenelmis vittipennis, Zimm.*

HETEROCERIDÆ.

Heterocerus mollinus, Kies.
two unnamed species.

DASCYLLIDÆ.

Ectopria nervosa, Mels. *var. thoracica*, Ziegl.
Prionocyphon discoideus, Say.
Scirtes orbiculatus, Fabr.*
tibialis, Guér.
Cyphon collaris, Guér.*
ruficollis, Say.
variabilis, Thunb.
obscurus, Guér.

ELATERIDÆ.

Tharops obliquus, Say.
Deltometopus amoenicornus, Say.
Dromœolus cylindricollis, Say.
Fornax badius, Mels.*
Hornii, Bv.*
orchesides, Newm.
Microrhagus imperfectus, Lec.
pectinatus, Lec.
triangularis, Say.
Hypocœlus frontosus, Say.*
Epiphanis cornutus, Esch.
Sarpedon scabrosus, Bv.*
Adolocera avita, Say.
aurorata, Say.
obtecta, Say.
brevicornis, Lec.
Alans occulatus, Linn.
myops, Fabr.
Cardiophorus amictus, Mels.
convexulus, Lec.
Cryptohypnus abbreviatus, Say.
pectoralis, Say.
Elater nigricollis, Germ.
linteus, Say.
discoideus, Fabr.
semicinctus, Rand.
vitiosus, Lec.
apicatus, Say.
luctuosus, Lec.
impolitus, Mels.
nigricans, Germ.
var. pedalis, Germ.
var. fuscatus, Mels.
nigrinus, Payk.*
pullus, Germ.
mixtus, Hbst.
miniipennis, Lec.
sanguinipennis, Germ.
rubicus, Say.
obliquus, Say.
protervus, Lec.
Drasterius dorsalis, Say.
Megapenthes stigmosus, Lec.
Ludius abruptus, Say.
Agriotes mancus, Say.
fucosus, Lec.
stabilis, Lec.
limosus, Lec.
oblongicollis, Mels.*
Dolopius lateralis, Esch.
Betarmon bigeminatus, Rand.
Melanotus decumanus, Er.
scrobicollis, Lec. ?
fissilis, Say.
communis, Gyll.
parumpunctatus, Mels.
Limonius confusus, Lec.
aeger, Lec.*
sp.
aurifer, Lec.
Campylus denticornis, Kirby.
Pityobius anguinus, Lec.
Athous Brightwelli, Kirby.
acanthus, Say.
cucullatus, Say.
rufifrons, Rand.

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discalceatus, Lec.
Sericosomus fusiformis, Lec.
incongruus, Lec.
viridanus, Say.
Corymbites virens, Schr.
vernalis, Hentz.
tesselatus, Linn.
resplendens, Esch.
cylindriformis, Hbst.
spinosus, Lec.
tarsalis, Mels.
sulcicollis, Say.
fallax, Say.*
medianus, Germ.
sulcatus (?)
triundulatus, Rand.
hamatus, Say.
hieroglyphicus, Say.
cruciatus, Linn.
aeripennis, Kirby.
splendens, Ziegl.
inflatus, Say.
Oxygonus obesus, Say.
Asaphes memnonius, Hbst.
var. brevicollis, Lec.
decoloratus, Say, *var. aereus*, Mels.

THROSCIDÆ.

Throscus constrictor, Say.
alienus, Bonv.

BUPRESTIDÆ.

Chalcophora virginiensis, Dr.
liberta, Germ.
fortis, Lec.
Dicerca prolongata, Lec.
divaricata, Say.
lurida, Fabr.
tenebrosa, Kirby.
chrysea, Mels.
lugubris, Lec.
Poecilonota cyanipes, Say.
Buprestis fasciata, Fabr.
var. sexplagiata, Lec.
consularis, Gory.
maculiventris, Say.
striata, Fabr.
Melanophila longipes, Say.
fulvoguttata, Harris.
Anthaxia viridicornis, Say.
viridifrons, Gory.
inornata, Rand.
Chrysobothris femorata, Fabr.
trinervia, Kirby.
dentipes, Germ.
pusilla, Lap.*
floricola, Gory.*
sexsignata, Say.
Harrisii, Hentz.
Agrilus ruficollis, Fabr.
fulgens, Lec.
otiosus, Say.
bilineatus, Web.
interruptus, Lec.
torpidus, Lec.
politus, Say.
egenus, Gory.
putillus, Say.*
sp.* (a)
Brachys ærosa, Mels.

LAMPYRIDÆ.

Calopteron reticulatum, Fabr.
var. apicale, Lec.
Celetes basalis, Lec.
Lopheros fraternus, Rand.
Eros thoracicus, Rand.
coccinatus, Say.
humeralis, Fabr.
Plateros modestus, Say.
caniculatus, Say.
Calochromus perfacetus, Say.
Lucidota atra, Fabr.
Ellychnia corrusca, Fabr.
Pyropyga nigricans, Say.
Pyractomena borealis, Rand.
Photinus ardens, Lec.

(a) Unknown to Dr. LeConte and not in Dr. Horn's collection.

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Photuris pennsylvanica, DeG.
Podabrus nothoides, Lec. (?)*
tricostatus, Say.
rugosulus, Lec.
diadema, Fabr.
modestus, Say.
punctatus, Lec.
Telephorus carolinus, Fabr.
scitulus, Say.
rotundicollis, Say.
tuberculatus, Lec.
bilineatus, Say.
Silis percomis, Say.
Malthinus occipitalis, Lec. *var. difficilis*, Lec.

MALACHIDÆ.

Collops vittatus, Say.
tricolor, Say.
Malachius Ulkei, Horn.*
Anthocomus Erichsoni, Lec.
flavilabris, Say?
Attalus morulus, Lec.

CLERIDÆ.

Cymatodera inornata, Say.
Trichodes Nuttali, Kirby.
Clerus nigripes, Say.
thoracicus, Oliv.
Thanasimus trifasciatus, Say.
dubius, Fabr.
var. rubriventris, Lec.
Thaneroclerus sanguineus, Say.
Hydnocera humeralis, Say.
var. difficilis, Lec.
pallipennis, Say.
verticalis, Say.
Chariessa pilosa, Forst.
Laricobius rubidus, Lec.
Corynetes violaceus, Linn.

PTINIDÆ.

Ptinus fur, Linn.
Eucrada humeralis, Mels.
Oligomerus sericans, Mels.
Hadrobregmus carinatus, Say.
foveatus, Kirby.
Anobium notatum, Say.
Trypopitys sericeus, Say.
Xyletinus fucatus, Lec.
Hemiptychus punctatus, Lec.*
Cænocara oculata, Say.
Ptilinus thoracicus, Rand.
Endecatomus rugosus, Rand.
Bostrychus bicornis, Web.
Dinoderus porcatus, Lec.
substriatus, Payk.
punctatus, Say.*

CUPESIDÆ.

Cupes concolor, Westw.

CIOIDÆ.

Rhipidandrus parodoxus, Beauv.
Cis, species unnamed.

SPHINDIDÆ.

Sphindus americanus, Say.

LUCANIDÆ.

Dorcus parallelus, Lec.
Platycerus quercus, Weber.
depressus, Lec.
Ceruchus piceus, Weber.

SCARABÆIDÆ.

Onthophagus Hecate, Panz.
Atænius gracilis, Mels.
Dialytes striatulus, Say.
Aphodius fossor, Linn.
hyperboreus, Lec.*
fimetarius, Linn.
granarius, Linn.
ruricola, Mels.
vittatus, Say.
inquinatus, Fabr.

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bicolor, Say.
Odontaeus cornigerus, Mels.
Geotrupes Egeriei, Germ.
Blackburnii, Fabr.
Trox porcatus, Say.
aequalis, Say.
scaber, Linn.
Hoplia trifasciata, Say.
Dichelonycha elongatula, Schön.
subvittata, Lec.
testacea, Kirby.
canadensis, Horn. (?)
albicollis, Burm.
Serica sericea, Ill.
vespertina, Schön.
Diplotaxis sordida, Say.
tristis, Kirby.
Lachnosterna fusca, Fröhl.
two unnamed species.
Ligyrus relictus, Say.
Xyloryctes satyrus, Fabr.
Osmoderma eremicola, Knoch.
scabra, Beauv.
Trichius affinis, Gory.

SPONDYLIDÆ.

Parandra brunnea, Fabr.

CERAMBYCIDÆ.

Orthosoma brunneum, Forst.
Tragasoma Harrisii, Lec.
Asemum moestum, Hald.
Criocephalus agrestis, Kirby.
Tetropium cinnamopterum, Kirby.
Gonocallus collaris, Kirby.
Dularius brevilineus, Say.
Hylotrupes ligneus, Fab.
Phymatodes dimidiatus, Kirby.
thoracicus, Muls.*
Merium proteus, Kirby.
Callidium janthinum, Lec.
antennatum, Newm.
aereum, Newm.*
Elaphidion villosum, Fabr.
parallelum, Newm.
incertum, Newm.
Obrium rubrum, Newm.
Callimoxys sanguinicollis, Oliv.
Molorchus bimaculatus, Say.
Purpuricenis humeralis, Fabr.
Cyllene robiniae, Forst.
Plagionotus speciosus, Say.
Calloides nobilis, Harr.
Arhopalus fulminans, Fabr.
Xylotrechus colonus, Fab.
sagittatus, Germ.
undulatus, Say.
Neoclytus capraea, Say.
muricatulus, Kirby.
erythocephalus, Fabr.
Clytanthus ruricola, Oliv.
Microclytus gazellula, Hald.*
Cyrtophorus verrucosus, Oliv.
Euderces picipes, Fabr.
Atimia confusa, Say.
Desmocerus palliatus, Forst.
Rhagium lineatum, Oliv.
Centrodera decolorata, Harr.
Toxotus Schaumii, Lec.
vittiger, Rand.
Pachyta monticola, Rand.
Anthophilax attenuatus, Hald.
Acmaeops proteus, Kirby.
pratensis, Laich.
Gaurotes cyanipennis, Say.
Bellamira scalaris, Say.
Typocerus velutinus, Oliv.
Leptura plebeja, Rand.
subhamata, Rand.
abdominalis, Hald. (?)* (b)
capitata, Newm.
zebra, Oliv.
saucia, Lec.*
sphaericollis, Say.
6-maculata, Lec.
nigrella, Say.
canadensis, Oliv.
chrysocoma, Kirby.
proxima, Say.

(b) Specimen retained by Dr. LeConte as "doubtful."

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vittata, Oliv.
mutabilis, Newm.
pubera, Say.
Psenocerus supernotatus, Say.
Monohammus maculosus, Hald.*
scutellatus, Say.
confusor, Kirby.
marmoratus, Rand.
Dorcaschema nigrum, Say.
Goes pulverulentus, Hald.*
occulatus, Lec.
Acanthoderes decipiens, Hald.
Leptostylus aculifer, Say.
parvus, Lec.*
commixtus, Hald.
macula, Say.
Liopus variegatus, Hald.
alpha, Say.
punctatus, Hald.*
cinereus, Lec.
Lepturges symmetricus, Hald.
signatus, Lec.
querci, Fitch.
facetus, Say.
Hyperplatys aspersus, Say.
maculatus, Hald.
Urographis fasciatus, DeG.
Acanthocinus obsoletus, Oliv.
Hoplosia nubila, Lec.
Pogonocherus penicellatus, Lec.
mixtus, Hald.
Eupogonius tomentosus, Hald.
vestitus, Say.
subarmatus, Lec.
Saperda calcarata, Say.
mutica, Say.*
candida, Fabr.
vestita, Say.
discoidea, Fabr.
tridentata, Oliv.
lateralis, Fabr.
moesta, Lec.
concolor, Lec.
Oberea amabilis, Hald.
bimaculata, Oliv.
Tetraopes tetraophthalmus, Forst.

CHRYSOMELIDÆ.

Donacia lucida, Lec.
proxima, Kirby.
subtilis, Kunze.
var. fulgens, Lec.
pubescens, Lec.*
emarginata, Kirby.
cuprea, Kirby, *var. aurifera*, Lec.
jucunda, Lec.*
flavipes, Kirby.
acqualis, Kirby.
sp.
Hæmonia nigricornis, Kirby.
Orsodacna Childreni, Kirby.
Zeugophora abnormis, Lec.*
Syneta ferruginea, Germ.
Lema trilineata, Oliv.
Anomœa laticlavia, Forst.
Chlamys plicata, Fabr. *var. polycocca*, Lec.
Cryptocephalus mammifer, Newm.
var. sellatus, Suffr.
var. pretiosus, Mels.
var. luteipennis, Mels.
badius, Suffr.*
4-maculatus, Say.
Schreibersii, Suffr.
Pachybrachys viduatus, Fab.
femoratus, Oliv.*
tridens, Mels.
litigiosus, Suffr. *var.*
Diachus auratus, Fabr.
catarius, Suffr.
Monachus saponatus, Fabr.
Xanthonia 10-notata, Say.
villosula, Mels.
Adoxis vitis, Linn.
Glyptoscelis pubescens, Fabr.
Chrysochus auratus, Fabr.
Tymnes tricolor, Fab.
Paria aterrima, Oliv.
6-notata, Say.
var. 4-notata, Say.
Graphops pubescens, Mels.
Colaspis puncticollis, Say.

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Prasocuris Phellandrii, Ill.
varipes, Lec.
Doryphora clivicollis, Kirby.
10-lineata, Say.
Chrysomela elegans, Oliv.
multiguttis, Stal.
var. labyrinthica, Lec.
philadelphica, Linn.
var. spireæ, Say.
multipunctata, Say.
var. Bigsbyana, Kirby.
Plagiodera lapponica, Linn.
viridis, Mels.
Phyllodecta vulgatissima, Linn.
Phyllobrotica decorata, Say.
discoidea, Fabr.
Diabrotica 12-punctata, Fabr.
vittata, Fabr.
Trirhabda canadensis, Kirby.
Galeruca 6-vittata, Lec.*
rufosanguinea, Say.
decora, Say.
sp. near decora.
sagittariæ, Kirby.
Oedionychis vians, Ill.
quercus, Fabr.
Disonycha limbicollis, Lec.
alternata, Ill.
caroliniana, Fabr.*
glabrata, Fabr.
triangularis, Say.
collaris, Fabr.
Haltica bimarginata, Say.
chalybea, Ill.
ignita, Ill.
Crepidodera helxines, Linn.
cucumeris, Harr.
Orthaltica copalina, Fabr.
Systena hudsonias, Forst.
frontalis, Fabr.
marginalis, Ill.
Longitarsus testaceus, Lec.
sp.
Phyllotreta vittata, Fabr.
Dibolia aerea, Mels.
Psylliodes punctulata, Mels.
Odontota rubra, Web.
nervosa, Panz.
sp. (?)
Chelymorpha argus, Licht.
Coptocycla aurichalcea, Fabr.
guttata, Oliv.

BRUCHIDÆ.

Bruchus pisi, Linn.
cruentatus, Horn.*
sp.

TENEBRIONIDÆ.

Phellopsis obcordata, Kirby.
Nyctobates pennsylvanica, DeG.
Ipthimus opacus, Lec.
serratus, Mann.
Upis ceramboides, Linn.
Haplandrus concolor, Lec.
Xylopinus saperdioides, Oliv.
Tenebrio molitor, Linn.
tenebrioides, Beauv.
castaneus, Knoch. (?)
Blapstinus interruptus, Say.
Tribolium ferrugineum, Fabr.
madens, Charp.
Paratenetus punctatus, Sol.
two unnamed species.
Diaperis hydni, Fabr.
Hoplocephala bicornis, Oliv.
Platydema excavatum, Say.
flavipes, Fabr.
americanum, Lap.
Scaphidema aeneolum, Lec.
Hypophloeus parallelus, Mels.
Boletotherus bifurcus, Fabr.
Boletophagus corticola, Say.
depressus, Rand.
Strongylium terminatum.*

CISTELIDÆ.

Allecula nigrans, Mels.
Hymenorus pilosus, Mels.
niger, Mels.
Cistela brevis, Say.

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sericea, Say.
Isomira 4-striata, Coup.
Mycetochares bicolor, Coup.
binotata, Say.
three unnamed species.
Capnochroa fuliginosa, Mels.
Androchirus fuscipes, Mels.

LAGRIIDÆ.

Arthomacra aenea, Say.

MELANDRYIDÆ.

Tetratoma truncorum, Lec.
Penthe obliquata, Fabr.
pimelia, Fabr.
Synchroa punctata, Newm.
Melandrya striata, Say.
Emmesa labiata, Say.
Phryganophilus collaris, Lec.
Xylita laevigata, Hellen.
Zilora hispida, Lec.
Enchodes sericea, Hald.
Serropalpus striatus, Hellen.
Hypulus simulator, Newm.
n. sp.
Scotochroa basalis, Lec.*
Dircæa liturata, Lec.
Symphora flavicollis, Hald.
rugosa, Hald.
Eustrophus bicolor, Fab.
bifasciatus, Say.
tomentosus, Say.
sp.
Hallomenus scapularis, Mels.
Orchesia castanea, Mels.
gracilis, Mels.
Canifa pallipes, Mels.
Stenotrachelus arctatus, Say.
Mycterus scaber, Hald.

PYTHIDÆ.

Crymodes discicollis, Lec.
Boros unicolor, Say.
Pytho niger, Kirby.
americanus, Kirby.
Salpingus virescens, Lec.
sp.

OEDEMERIDÆ.

Ditylus cœruleus, Rand.
Asclera ruficollis, Say.
puncticollis, Say.

CEPHALOIDÆ.

Cephaloon lepturides.

MORDELLIDÆ.

Anaspis flavipennis, Hald.
rufa, Say.
Tomoxia bidenta, Say.
Mordella borealis, Lec.
melaena, Lec.
scutellaris, Fabr.
marginata, Mels.
irrorata, Lec.*
Mordellistena trifasciata, Say.
limbalis, Mels.
scapularis, Say.
aspersa, Mels.*
comata, Lec.*
pectoralis, Lec.*
fuscipennis, Mels.
ambusta, Lec *var.**

ANTHICIDÆ.

Corphyra Newmani, Lec.
lugubris, Say.
fulvipes, Newm.
terminalis, Say.*
Notoxus anchora, Hentz.
sp.
Xylophilus fasciatus, Mels.
basalis, Lec.
two unnamed species.
Anthicus formicarius, Laf.
fulvipes, Laf.*
cinctus, Say.*
thoracicus Laf.*
two unnamed species.

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PYROCHROIDÆ.

Pyrochroa flabellata, Fabr.
  femoralis, Lec.
Schizotus cervicalis, Newm.
Dendroides canadensis, Latr.
  concolor, Newm.

MELOIDÆ.

Meloe angusticollis, Say.
  americanus, Leach.
  n. sp.?
Macrobasis unicolor, Kirby.

RHIPIPHORIDÆ.

Pelecotoma flavipes, Mels.

RHINOMACERIDÆ.

Rhinomacer pilosus, Lec.

RHYNCHITIDÆ.

Rhynchites cyanellus, Lec.
  æratus, Say.*

ATTELABIDÆ.

Attelabus rhois, Boh.

OTIORHYNCHIDÆ.

Phyxelis rigidus, Say.
Otiorhynchus ligneus, Oliv.
Scythropus elegans, Coup.

CURCULIONIDÆ.

Sitones flavescens, Marsh.
Trichalophus alternatus, Say.
Ithycerus noveboracensis, Forst.
Apion herculaneum, Smith.*
  Walshii Smith.*
  segnipes, Say.*
  several unnamed species.
Phytonomus nigrirostris, Fabr.
Listronotus caudatus, Say.
Macrops solutus, Boh.
  several unnamed species.
Pissodes strobi, Peck.
  affinis, Rand.
Hylobius pales, Hbst.
  var. stupidus, Boh.
Dorytomus mucidus, Say.
  longulus, Lec.*
Grypidius equiseti, Fabr.*
Procas picipes, Steph.*
Tanysphyrus, lemnæ, Fabr.
Anchodemus angustatus, Lec.*
Otidocephalus Chevrolatii, Horn.*
Magdalis barbita, Say.
  olyra, Hbst.
  inconspicua, Horn.
  armicollis, Say.
Anthonomus quadrigibbus, Say.
  signatus, Say.
  rubidus, Say.
  suturalis, Lec.
  musculus, Say.
  sp. near disjunctus, Lec.
Orchestes niger, Horn.*
  subhirtus, Horn.*
Elleschus ephippiata, Say.
  bipunctatus, Linn.*
Gymnetron teter, Fabr.
Conotrachelus nenuphar, Hbst.
  posticatus, Boh.
Pseudomus truncatus, Lec.*
Tyloderma æreum, Say.
Cryptorhynchus obliquefasciatus, Boh.
Acoptus suturalis, Lec.*
Mononychus vulpeculus, Fabr.
Centorhynchus dicipiens, Lec.*
Cœlogaster cretura, Hbst.
Madarus undulatus, Say.
Stethobaris tubulatus, Say.*
Balaninus rectus, Say.
  nasicus, Say.

BRENTHIDÆ.

Eupsalis minuta, Drury.

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CALANDRIDÆ.

Spenophorus pertinax, Oliv.
sculptilis, Uhler.
Dryopthorus corticalis, Say.
Cossonus platalea, Say.
Rhyncholus oregonensis, Horn.*
Stenoscelis brevis, Boh.

SCOLYTIDÆ.

Pityophthorus materiarius, Fitch.
pubernlus, Lec.
sparsus, Lec.
Xyloterus retusus, Lec.
bivittatus, Hb.
Xyleborus cælatus, Eich.
Tomicus calligraphus, Germ.
pini, Say.
Hylesinus opaculus, Lec.
Phlœosinus dentatus, Say.
Dendroctonus terebrans, Oliv.
Hylastes cavernosus, Zimm.
Hylurgops, pinifex, Fitch.

ANTHRIBIDÆ.

Allandrus bifasciatus, Lec.
Hormiscus saltator, Lec.
Anthribus cornutus, Say.
Cratoparis lunatus, Fabr.

FAMILIES, 67; GENERA, 524; SPECIES, 1,003.

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SUCTORIA.

J. B. Tyrrell, B.A., F.G.S., of the Geological and Natural History Survey of Canada.

Read 14th February, 1884.

It would be almost a truism to say that we are indebted to Linnæus for first giving the fleas a systematic position in the animal kingdom. He ranked them under the genus pulex, and placed this genus, along with many other dissimilar ones it is true, in the order aptera, an order under the class insecta. Lamarck also placed them under the same order, and it was left for Latreille in 1805 A.D. to separate them under the name suctoria, though he afterwards abandoned it and adopted the name siphonaptera for these insects. In 1826 Kirby and Spence used the name aphaniptera for the same group, which is that ordinarily used in English books on entomology. In 1844 Gervais described all the species then known of the genus pulex, in a work by Walkeraer and Gervais on "Aptera," a work which is still the principal book of reference on all the so-called apterous insects. In 1867 Landois gave us a careful description of the anatomy of the dog-flea (*Pulex canis*). and in 1880 O. Taschenberg in an exhaustive paper redescribed all the species that were then known, and after a careful examination of those found on a number of different animals considered that, with the exception of ten described species which he had not seen, all could be referred to 24 species grouped under five genera.

The insect itself, as most of you are aware, is of a dark brown colour and from $\frac{1}{20}$ to $\frac{1}{5}$ in. in length, according to the species to which it belongs; is strongly compressed laterally, and possessed of powerful legs adapted for leaping. The head is relatively small, usually rounded on the upper side, and in most species more or less evenly curved from the neck to the point of insertion of the oral appendages. The hinder border of the head projects in two wing-like chitinous processes, which are inserted between the wings of the thorax, while at the same time the hinder border of the head overlaps the front of the thorax in its whole extent. This is noticeable, as it is very different from the arrangement

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in the diptera, with which the fleas are usually allied. The head is divided into two nearly equal parts by the antennary groove, in front of which are placed the eyes (when these are present) and the oral appendages. The eyes are simple, and normally appear as dark brown or black spots close to the antennary groove and towards the lower side of the head. On the side of the head are seen several chitinous hairs, which from their position and size in different species form useful specific characters. These are used in assisting the insect to obtain a strong hold on the skin of its host.

The oral appendages are adapted for suction and consist of a pair of free plates and a tube made up of five separate pieces.

The free plates are the maxillae, and are usually triangular in outline and of a dark chitinous colour. Each maxilla bears at its base a four-jointed palps, the joints of which are of different lengths in the different species, and are partly covered with fine hairs. These are the organs which were by old observers taken for the antennæ.

The peculiar sucking tube is formed from the lower lip or labium, the mandibles and an impair piercing tube or lingua.

The labium is impair at its base, then bifurcates, dividing into two four-jointed palps, each of which is hollowed out on the inner side. On the upper side this palp is thick, but it thins out and becomes membraneous on the lower side, being in shape somewhat like the blade of a hollow ground razor. These two half tubes lie together and enclose the mandibles and the lingua.

The paired mandibles are long, narrow, longitudinally ribbed, and are also deeply excavated along the inner side, while the borders, except at the base, are strongly serrated, the teeth becoming more prominent towards the outer end.

In the tube formed by the mandibles, which are generally pressed close together, lies the suctorial organ, or lingua, in the form of a flattened needle, coarsely serrated on the upper border and traversed by a narrow canal, along which runs a very slender trachea or air-tube. At its hinder end it enlarges into a rounded sac before opening into the oesophagus. This organ is considered by some as representing the upper lip or labrum, but, on account of its mode of insertion rather

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than from any developmental relations, we have considered it, on the authority of many entomologists, as homologous to the lingua in other insects.

After thus considering the oral appendages at considerable length for so short a paper, as they are the parts which render the order most annoying, if not to ourselves at all events to our domestic favourites, we must hasten on to describe some of the other parts in the anatomy of these insects.

The antennæ are hidden in the grooves which run obliquely backwards and downwards across the head, and it is but seldom, and then only in a few species, that we see them carried erect. Behind the groove on each side a row of small hairs is usually present. The antenna itself is composed of three segments, the third being divided by a number of transverse membraneous joints by means of which it can be lengthened and shortened at the pleasure of the insect. On the back of this segment can be seen in some species a number of small sacs which are probably auditory. Towards its base it contracts considerably to the point where it articulates with the second segment. A row of strong bristles is often present around the anterior end of this latter, standing like guards around the terminal segment.

The thorax is small and composed of three separate segments protected by a chitinous covering, each composed of a dorsal piece or notum, and two lateral pieces or pleurae, which latter are largely developed at the expense of the sternum. The pleurae are more or less freely joined to the notum, the anterior ones being thrown forward almost under the head. On the posterior borders of the pleurae of the two hinder segments of the thorax small scales are present, which by some entomologists are considered as rudimentary wings, though by others this homology is denied. The pronotum on its hinder border is often provided with a collar of bristles which from their different size and number serve as good characters for distinguishing the species.

The legs, which are attached to the pleurae of the three thoracic segments, are large, increasing in size from the first to the third pair, and adapted for leaping. The whole leg is, like the rest of the body, laterally compressed, and consists of five joints, viz., the very large coxa, the trochanter, the femur, the tibia, and the tarsus or foot, which

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in its turn is divided into five joints and terminated by two strong claws. The relative length of these tarsal joints is usually used as a distinctive specific character.

The abdomen constitutes the largest part of the body, and is made up of nine segments, the greater number of which are covered by dorsal and ventral chitinous plates, which overlap those of the segment in front. The first segment, however, has a dorsal plate only; the second to the seventh are normally formed. The eighth segment has a somewhat peculiar shape, and differs in the two sexes. In the female the dorsal plate is largely developed at the expense of the ventral, the latter being very much reduced; while in the male the ventral plate is about equal in size to the dorsal. The pygidium or ninth and last segment, which is the smallest of all, is situated in a depression in the eighth, and is composed of three pieces, a dorsal and two ventrals. The former is oval in shape and surrounded by a chitinous ring which encloses 25–28 areoles, each of which bears in its centre a small stiff bristle. In the male this segment is thrown very much farther up on the dorsal surface than in the female.

Respiration is carried on through a system of tracheæ, which, open on the surface of the body in ten pairs of stigmata, two on each of the thoracic rings and the seven anterior segments of the abdomen.

The alimentary canal is composed of a short straight oesophagus opening into a cylindrical stomach, from which the food passes by a short intestine to the anus, situate below the ninth abdominal segment. Two salivary glands open by a single duct into the oesophagus, and four glands, which probably serve the purpose of a liver, open into the lower end of the stomach.

The eggs of the flea are small white oval bodies, which, when newly laid, on account of their viscous exterior, adhere to anything with which they may come in contact.

The larva is footless and made up of thirteen nearly equal segments, the anterior of which, the head, is hard, chitinous, and bears the antennæ and oral appendages, though eyes are absent. The oral appendages are composed of a pair of conical toothed mandibles, a pair of chitinous maxillae, with a two-jointed palp attached on each side, and an upper and lower lip. A small provisional organ, like that on the

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bill of a chick, is also present, as a chitinous knob on the dorsal surface, for the purpose of breaking the shell of the egg. The second to the eleventh segments are each provided with a pair of lateral stigmata. The thirteenth segment is provided posteriorly with two strong spines, which are the principal organs of locomotion. The larva, after leading a very active life for a short time, spins a cocoon about it and passes into the pupa state. In this state of development the structure of the body corresponds to that of the adult insect, all the organs of manducation and locomotion being present. After remaining in the pupa state for about thirty days the insect emerges as the perfect imago.

Having taken more time than I had originally intended in describing the anatomy of these interesting parasites, a mere mention of a few of the more common and characteristic species must suffice.

Pulex (Sarcopsylla) penetrans.—the Chicoe or Jigger—is found in tropical countries. The female bores into the feet and ankles of men, and many of the domestic animals, and, the abdomen being distended as the ova undergo development, swells up to about the size of a pea, causing often very severe inflammation.

Pulex irritans is the flea usually found in filthy dwellings, the larva being in the dust and dirt on and around the floors. It is distinguished from others ordinarily met with by having no collar of bristles around the neck.

Pulex canis is found on dogs, cats., etc. It has a prominent collar around its neck and a row of bristles along the under side of the head.

Pulex fasciatus is found on the rat, mouse, etc. It has a row of bristles around the neck, but none on the lower side of the head.

Pulex (Typhlopsylla) assimilis is found on the mole, shrew, etc., and has been found by Mr. J. F, Whiteaves, of this city, on the chipmunk, *Tamias striatus.* The body is long and thin, the eyes are rudimentary, and there is a row of eighteen bristles around the neck.

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ON THE OCCURRENCE OF PHOSPHATES IN NATURE

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Read 28th February, 1884.

In proposing to review, in so short a paper, as this must necessarily be, a subject so extensive as that indicated by the title, a difficult task has been undertaken, and I cannot hope to do more than touch upon its main points.

In the first place it may be proper to enquire why phosphate materials are now so much sought for as fertilizers.

It has been said laconically that "Phosphorus is life," but this like most bold generalizations is but a partial, and even misleading statement of the fact. Certain it is, however, that this element, variously combined, is present in all living tissues, whether vegetable or animal, and though in small quantity only, is absolutely essential to these tissues, and, therefore, to the manifestation of life. Animals, depending ultimately for their subsistence on plants, derive from these their supplies of phosphorus, together with the other substances necessary for their nutrition. Unlike the animal, the plant is capable of living, ultimately, on inorganic substances, and while deriving a large part of its food from the air, is absolutely dependent on the soil for those incombustible constituents which, when the plant is burnt, remain as ash. Without these the growth of the plant is impossible, and it is therefore necessary to ensure a sufficient supply of them in the soil. Phosphorus, in a state of combination, is one of these, and that to which I wish particularly to refer.

In following this substance from the soil to the plant, from the plant to the animal, and from the animal again to the soil, we find a system of circulation, which, under certain conditions, might go on indefinitely. In a state of nature, this cycle is generally complete, but it is interfered with and broken by the present organization of humanity, and more particularly by those arrangements which have resulted in the massing of population in large towns. In these it is found necessary to remove the effete and excrementitious matters by a system of

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sewage, which results in draining the phosphates, and other substances valuable from an agricultural point of view, into the sea, where they may be considered as absolutely lost. Victor Hugo, in a well known passage, contrasts the wealth to be seen rolling through the streets of Paris to that which is silently but steadily flowing away by the sewers beneath, which he maintains is greater. Be this as it may, in this particular case there is a continuous process on a large scale in action, by which the land is deprived of its phosphates, and particularly in a country like this, which exports great quantities of food material, with their contained phosphates, to be consumed abroad.

Some years ago (1869) Mr. Gordon Brown calculated the amount of phosphorus actually contained in the grains annually shipped from the port of Montreal, estimating it for this purpose in the form of phosphoric acid. Wheat contains about $\frac{8}{10}$ (eight tenths) per cent. of phosphoric acid, or about 16 pounds to each ton, and as the total shipments of wheat amounted to 292,534 tons, the quantity of phosphoric acid sent away in it equalled 2,340 tons. Taking the average quantity of this substance contained in good soils, he found that this meant the total exhaustion to a depth of 12 inches—in so far as phosphates are concerned—of 70,320 acres, and would require the use of 5,850 tons of apatite of good quality as manure to maintain the fertility of the fields. Adding to this the amount of phosphoric acid contained in other grains exported he found the total loss in the year to be 2,574 tons of phosphoric acid, representing a value of over $500,000.

With such statistics in evidence it will not be necessary to enlarge further on the necessity of discovering a source of supply of phosphates for our fields, and for this we must have recourse to some specially concentrated natural deposits. What therefore is the nature of these, how have they been formed, and where do they occur?

In answering these questions, it must be remembered that soils have been produced by the decay and disintegration of rocks, and have derived their contained phosphates from the rocky crust of the earth. Good soils contain say about $\frac{2}{10}$ (two-tenths) per cent. of phosphoric acid, and on analysing rocks chemically or microscopically we find phosphates—generally calcic phosphate—present in them in similar small proportions.

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In some crystalline rocks we find apatite, or crystalline calcic phosphate so abundant that it can easily be recognized under the microscope. It is needless to say, however, that the percentage of phosphate present in ordinary rock masses is quite too small to suit them to be used as fertilizers for exhausted soils. We must have recourse to some richer sources of supply, and the concentration of phosphates in nature is generally found to have been brought about by organic agency. Of these concentrated deposits of phosphatic matter we may first glance at those known as Guanos. These are essentially composed of excrements of sea birds. Extensive accumulations of this character can occur only in dry climates, for though formed wherever sea birds congregate in great numbers, the rainfall is usually sufficient to remove them before they reach important dimensions.

Guanos are naturally divided into two classes, though between the extremes of these there are many intermediate varieties. These classes have been named respectively nitrogenous and phosphatic Those of the first class occur in exceptionally dry climates, such as are found on the coast and adjacent islands of Peru, Bolivia and Chili, where rain seldom or never falls. In these the nitrogenous constituents of the organic matter—converted by decomposition into ammonia salts—remain as a part of the mass. In phosphate guanos, on the contrary, the rainfall has been sufficient to remove the whole or nearly the whole of the very soluble ammonia salts, while not enough to wash away the phosphatic material. Guanos of this class are of common occurrence in the West Indian islands, and in some of these in which the subjacent coral rock is penetrated by caverns, only such parts of the phosphatic accumulations are preserved as have been washed into these subterranean hollows through fissures, or have penetrated to them in solution through the porous coral rock.

In the Ardennes region of the south of France, phosphatic deposits occur which, in my opinion, are very similar in origin to those just alluded to. These, however, are very much older and in fact include fossils of Tertiary age, and so far as known, none of modern forms. They fill irregular cavernous fissures which traverse the surface of plateaus composed of Jurassic limestone, and it would appear that the higher parts of these plateaus have at one time formed an archipel-

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ago of bird-frequented islands in a Tertiary Sea. The phosphate or phosphorite from these deposits is known commercially as *Bordeaux* phosphate—from its port of shipment—and though very irregular in its occurrence, is largely worked and exported.

Phosphatic deposits like these, however, directly referable to surface accumulations by sea birds, are as a rule quite modern. With rare local exceptions any which may have been found in the earlier geological periods have been washed away and lost; the very process of submersion, necessary as a preliminary step to the preservation by burial in the strata, causing their dissipation.

Most of the truly fossil phosphates found in connection with the older rocks have been formed in a quite different manner. To understand this we may examine first such modern deposits as the "Mussel Muds" of Prince Edward Island. These are accumulations produced in shallow tidal estuaries where great numbers of molluscs and other marine organisms are going to decay, so rich in phosphates and organic matter as to be of great value locally as a manure. Deposits more or less closely resembling these are found in many parts of the modern sea bottom and along the coast, and where just such deposits have been buried deeply, and included in some of the older formations, they produce what are known as "Coprolite beds." This term, however, it must be explained, is in general very loosely applied. It should be restricted to the fossil excrements of various animals, which are occasionally found in the rocks, and often in such beds as those just referred to, but seldom even then constitute more than a small part of the phosphatic matter, most of which usually occurs as concretions or nodules. These have resulted from that slow process of drawing together of like particles in the mass, which is usually designated concretionary action, but is not in all cases fully understood. A fragment of shell, or bone, or a tooth frequently serves as the nucleus of such a concretion, and when the material is abundant such concretions frequently coalesce and form almost continuous layers. The so-called *coprolite beds* of Cambridgeshire, Bedfordshire and other localities in England, and those of Carolina, in the Southern States, are of this nature.

The last named deposit dates no farther back than the Tertiary,

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and consists of a layer, usually from six to fifteen inches in thickness charged with nodules of calcic phosphate and containing also bones, teeth and shells, the pores of which have been more or less completely filled with the same material. This deposit lies at no great depth below the surface, and is still nearly horizontal. In some places it is below high-water mark, and large quantities of the phosphatic nodules are obtained by dredging in some of the estuaries and channels which penetrate the low alluvial country. Where the nodule-bed occurs above the sea level it is worked by a system of trenching, the finer material being washed away on gratings, and the nodules then dried—generally by artificial heat—before being sent to the mill.

A long way farther back in time are the "Coprolite" beds of the south of England, which date in fact from the Cretaceous period. Where this deposit occurs at an inconsiderable depth below the surface, it is worked by a system of trenching similar to that employed in Carolina, the soil being carefully put to one side and subsequently restored, and the land again brought under tillage. As the deposits are thin, it does not pay to follow them to any great depth, but some years ago the annual product was as much as 25,000 tons.

These can be considered only as instances of the mode of occurrence of phosphatic materials in the geological series. Deposits more or less closely analogous to those described and sufficiently rich to work are found in a number of other localities, which we have not now time to consider. There is reason to believe that phosphatic or "coprolitic" nodular deposits have been found wherever the local conditions were favourable and large quantities of animal matter were in process of accumulation and decay, throughout the entire geological series. Going a great way back in geological history, we find instances of this in Canada in parts of the Chazy subdivision of the Silurian, in the graptolitic shales ot the Quebec group, and even in the Cambrian rocks of St. John. It is true that none of these deposits are of importance from an economic point of view; for instances of workable deposits in these palæozoic rocks we must turn elsewhere. They are merely mentioned here for the purpose of connecting the occurrence of naturally concentrated phosphatic materials as found in the newer rocks, with the deposits of the same material found in the oldest known rocks—those of the Laurentian period.

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In the Laurentian rocks—which are those characterizing the great country to the north of the Ottawa, and elsewhere very largely developed in Canada—we have a great volume of sediments, deposited in an ocean of vast antiquity, the earliest in fact of which we find any traces. These sediments which, no doubt, originally resembled in their main features those of later ages, have since been so completely metamorphosed that their materials have entered into new combinations among themselves and become entirely crystalline. While, therefore, still consisting of the *materials* originally deposited, they resemble them as little in appearance as do the crude ingredients of glass the finished product. There can, however, be no doubt of the original sedimentary origin of these Laurentian rocks, the change from muds and sands—and I would also include contemporaneous volcanic materials—to wholly crystalline rocks such as these, is seen in less metamorphosed formations in various parts of the earth's crust, and has been traced in all its stages. If, therefore, ordinary limestones were originally present in these old rocks, we would expect them now to have assumed a wholly crystalline character, and to appear as marbles. Contained beds of a peaty or coaly nature might be expected to pass into crystalline carbon or graphite, and phosphatic nodular or coprolitic layers could appear only as crystalline calcic phosphate or apatite. As a matter of fact we find all three of these substances in the Laurentian, and though the proof may not be absolute that their origin and appearance was at first the same as that of analogous materials in the newer rocks, the evidence is all in that direction.

The main facts in regard to the mode of occurrence of these deposits of apatite in Canada, so far as our knowledge goes, must be very briefly presented. Some of the beds in the Laurentian series are found to be comparatively rich in apatite, crystals and crystalline masses of this mineral being scattered through them. This is the case in some of the marbles, occasionally in the iron ores, and also particularly in connection with the pyroxenic rocks. In addition to these, in which the apatite may be considered as generally distributed, certain layers, apparently of the character of beds, occur, consisting of nearly pure apatite, or containing so large a proportion of the mineral as to pay for working. Still further, we find distinct veins and fissures which have

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been filled with apatite by processes of segregation in which the mineral is found either nearly pure, or, more frequently, mingled with crystals of other substances.

Though the exportation of these Canadian deposits may, I believe, be considered as still in its infancy, it has already assumed considerable proportions. Quoting from an interesting paper read a few days ago by Dr. Sterry Hunt, before the American Institute of Mining Engineers, we find that the amount shipped from Montreal, in 1883, was 17,840 tons, of which a portion was delivered in Hamburg and Stockholm, but the greater part went to British ports. Of this amount 15,000 tons were from Quebec, the remainder from Ontario. It is estimated, according to Dr. Hunt, that the shipments during the present year will amount to 24,000 tons.

Besides the very wide spread of these apatite deposits and their great economic importance, one of the most striking facts so far developed is their great irregularity. Taking into consideration the extremely disturbed character of the Laurentian rocks, this is easily understood. Layers and veins which may, before the great folding and kneading together of these rocks, have possessed considerable regularity and uniformity, have been, as a consequence of the excessive disturbance, folded and dislocated in every sense, leading to the production of large pockets and irregular masses of apatite which may now be connected only by narrow and twisted seams, or may occupy what appear to be completely isolated positions.

This being the case, it may be asked : can a Geological Survey do anything to aid in the discovery of apatite and the development of this mining industry? Fortunately we are not quite without a clue in the matter. It has already been discovered (largely by Mr. Vennor's work) that certain broad zones of the Laurentian series, (in part already traced out and mapped,) contain most of the workable deposits of apatite, while extensive intervening belts of country show comparatively little apatite and offer little encouragement to the miner. These zones are pretty clearly recognizable by their composition and character, and though much has already been done in the matter of defining them, much more yet remains to do. They can, it would appear, be mapped down with a degree of certainty nearly as great as regions capable of

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yielding good lumber, or lands suitable for farming can be defined by explorations with these particular ends in view. The further question involved in the utilization and working of special local deposits is also one requiring sagacity and special knowledge, but cannot be considered as within the province of a public survey. Like the enquiry as to how many feet of sawn lumber a given tree will afford, or how best to lay out a certain plot of a couple of hundred acres for farming purposes, this remains to be determined by the person who wishes to utilize these for his own pecuniary benefit.

Mr. J. Fraser Torrance being called upon, at the suggestion of the lecturer, explained that the heaviest deposits of phosphate in the County of Ottawa lie along the valley of the Lièvres. As you move either eastwards or westwards from this river, the deposits usually become more and more intermixed with calcite, until they finally cease to be profitably workable. The methods of mining employed are of the rudest and most elementary kind. The only hoisting and pumping machinery employed (with very rare exceptions) is a tub on the end of a rope swung over the pit by a derrick worked with one horse. The pits are almost all quite as wide at the mouth as below and are well calculated to collect all the surface water, snow, etc. The managers have evidently adopted the maxim of Louis XV: "After me the deluge." Deeper sinking will be attended with great difficulty on account of the quantity of water collected in these shallow pits.

Almost all of the pits visited by him were neither veins nor beds, but irregular segregations from the surrounding rock. In most cases it was hard to tell where to draw the line between the ore and the waste rock.

One reason why so little apatite was converted into superphosphate in Canada he believed to be the reckless manner in which the materials were mixed and branded *in former days* by the company at Brockville. The farmers had no guarantee that any two barrels of the same brand would be of even approximately equal value for their lands. He hoped these errors had all been corrected since his visit to Brockville years ago. The Ontario Agricultural College at Guelph is doing good service in convincing farmers of the practical value of such fertilizers.

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Although we exported 19,000 tons of apatite last year, almost every ton of it was shipped to Great Britain and Europe. The quantity sent to the United States was trifling. This was the more remarkable as a large amount of American capital is invested in our Canadian apatite deposits. From the statistics supplied to him by Mr. Nimmo at Washington, it appeared that in the year ending 30th June, 1883, the United States imported 49,381 tons of crude phosphate, valued at $429,391; 39,119 tons of Kainit, valued at $246,231, and 7,666 tons of superphosphate, valued at $120,576. Of this quantity, 1,262 tons of crude phosphate and all the superphosphate came from Britain. It thus seems reasonable to infer that some of our Canadian apatite was merely reshipped to the United States from Great Britain without any fresh treatment there, while a much larger quantity was first converted into superphosphate there and shipped in that form to the United States.

The only explanation of this anomaly seemed to be that it was a fresh proof of the conservative nature of trade. The American dealers were in the habit of importing from Britain long before our Canadian deposits of apatite were opened. When these were first opened it was done by men more familiar with the English market than the American. It was less "bother" to ship from Montreal to the Mersey or to Bristol, than to load barges there for New York. After the trade was once established no determined effort seems to have been made to direct it into fresh channels.

It was worth while to notice also in this connection that, although plumbago to the value of $361,949 was imported into the United States last year, not one pound of it came from Canada. The lack of skill or reckless folly of our miners in shipping inferior stuff to gain a temporary profit has given Canadian plumbago a bad name that it may be almost impossible to overcome. Mr. Hoffmann's admirable report showed that it was really quite as good as that from Ceylon.

Mr. F. D. Adams stated that in the Transactions of the Geological Society of Stockholm for April, 1883, H. Sjogren had given a very interesting account of the apatite deposits at Oedegarden in Bamle, Norway. At this one locality alone, in 1882, between 700 and 800 men were employed in mining the apatite, and about 15,000 tons were

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raised. The rocks of the district are quartzites overlain by mica-schists, hornblende schists, gabbos and dipyr-diorites, which pass into one another. The apatite veins occur only in the gabbo and dipyr-diorite, or in the immediate vicinity of these rocks, which, although contemporaneous with the other schists, are considered to have probably had an eruptive origin. He believed the apatite to have been derived from the gabbo and dipyr-diorite, and deposited by water in clefts caused by the contraction of the rock on cooling. The apatite deposits of Norway and Canada being so like one another in many respects, it might be supposed that when such a constant relation between the apatite and gabbo was found to exist in the former country, a similar relation would obtain in the latter, but this was apparently not the case. The dipyr-diorite had, however, lately been recognized by him among a collection of rock fragments, from the vicinity of Arnprior, sent to the Survey for examination, and a description of it would shortly be published.

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THE DEER OF THE OTTAWA VALLEY.

W. P. Lett.

Read 13th March, 1884.

The moose (*Alce Americanus*, Jardine, considered by many naturalists to be identical with *Alce malchis*, Linnæus, of the old world) or American elk, is the largest of all deer now existing in the world, although much inferior in size to the ancient Irish elk, which must have been an animal of gigantic proportions, if we are to judge by the size and weight of the ponderous antlers occasionally found in the bogs of Ireland many feet beneath the surface. Some specimens of these great horns have been exhumed, with a spread of twelve feet, which will give some idea of the magnitude of the animal which carried them. The American moose, according to the conclusions of all scientific naturalists, is a true elk, identical with the ancient Irish elk, the Scandinavian and the Asiatic elk. A moose of the largest size, when fat, will weigh upwards of fifteen hundred pounds. A bull moose of this description is as tall as the largest horse. The body and neck, for so tall an animal, are short and stout, the neck so much so that the animal cannot touch the ground with his lips, without kneeling. The neck is covered with a thick mass of coarse bristly hair, rising on the crest into a stiff mane, which, when the animal is irritated, stands on end like the mane of a lion, and imparts to the infuriated beast a frightful and most formidable aspect. The legs are long and bony, and, although ungainly in appearance, are are as clean cut and compact as the limbs of a racer. The head is enormously large, and altogether deficient in the fine points of grace and beauty peculiar to nearly all the other branches of the deer family. The fleshy part of the upper jaw terminates in a long flexible upper lip with prehensile powers, used by the animal for the purpose of catching the twigs and branches on which it feeds. The nostrils are long and wide, and the eyes are somewhat small in proportion to the bulky head. The hoofs are large and shaped like those of the common deer. The colour of the hair in the summer coat is nearly black, particularly about the head, back and belly. At this season the hair is short and glossy. In winter the animal is covered with long coarse hair of a brittle nature,

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and the colour is lighter in hue, a sort of greyish brown tinge prevailing on the sides, with the belly of a somewhat lighter colour. A tuft of hair nearly one foot long hangs under the jaws of the young moose. "Moose" is an Indian name derived from the Algonquin word moussee, the eater. I quote the following description from Billings in the "Canadian Naturalist and Geologist":—

"The gigantic horns of the moose are well known in almost every town in Europe and America where there is a museum. It is difficult to believe that these enormous solid appendages are the growth of a single season, and yet the fact is too well established to admit of a doubt. Only the males are provided with them, and no matter how large they may be, they grow to their full size in twelve or fourteen weeks. On the young moose one year old they are merely short knobs; they increase in size after each annual shedding, and after the fourth year become palmated, and may be termed full grown about the fifth year. The palms are, in the widest part, on a moderate sized male, about eleven inches wide, the space between the roots, six or seven inches. A very large pair measures over five feet between the tips, and will weigh 60 or 70 pounds. They begin to sprout in April and fall off in February. It is said that their growth is complete in August, when the velvet peels off, and they are then white, but afterwards become brown or yellow. From one to three points, or short prongs, are added to the palms each year, so that the age of the animal is not indicated by the number of these prongs as is generally supposed. In fighting with each other, they use both horns and feet; but in contending with dogs, only the latter, with which they strike tremendous blows. Their pace is a long swinging trot, which they can keep up for several hours in succession." A wounded moose is a very dangerous antagonist to approach unprepared. By an eye witness I was told of a case in point. A shantyman, on the Black River, at some place above Pembroke, ran out in sight of a number of his comrades close to the shanty, with a single barrelled muzzle-loader, and fired at and severely wounded a large bull moose. Seeing the animal wounded, he ran up to him with an empty gun, when the moose rushed at him, knocked him down with a blow from one of his front feet, and before his friends could effectually interfere, the furious animal trampled and pounded the

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unfortunate man to death. I have heard also of instances where hunters have been treed by wounded moose; and of one incident where a hunter escaped by dodging around a large tree until he got a second charge into his gun to administer the quietus. To shoot a moose in December or in the middle of January, when he strides proudly along beneath the weight and dignity of his lordly crown, and when he is fat and heavy, is something of which a sportsman may well feel proud; but to slaughter the unfortunate animals in the latter end of February or March, when the females are heavy with young and the males are hornless and lean, is a species of assassin work which ought to be summarily put down by the strong arm of the law, if men are not ashamed of such culpable and inhuman butchery. The moose, which at one time was found in abundance in all the northeastern States of America, at present holds, says Parker Gilmore, "a short leased existence in the northern portions of the State of Maine." They are also in decreasing numbers to be met with in Nova Scotia and New Brunswick, and in various parts of the North-West. Although diminishing every year, they are comparatively plentiful far back on the north side of the Ottawa River throughout its entire length, and in some localities far west on its southern side. In the country lying to the south of James' Bay and stretching westward to Lake Winnipeg, this giant deer can be found in greater abundance than in any other portion of the American continent. Moose are also found in considerable abundance in the country bordering on the St. Lawrence below Quebec, particularly in the Labrador region. Audubon says the moose grows to the height of twenty hands. Others say that they grow even much taller than that. The moose of Labrador are much smaller than those of the State of Maine, or Canada proper, owing, doubtless, to the severe winter and sparse vegetation of the former locality. The moose when captured young is easily domesticated and grows quite tame and docile; but the restraints of civilization do not seem to agree with him, and after a few years' confinement he pines away and dies. In a park of sufficient size, well supplied with hardwood bush and swamp, and well watered, doubtless the animal would thrive. In a state of domestication the moose has been trained to harness, but does not like it, yet when it pleases him to stretch out into a trot he is exceedingly fleet. I have frequently

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seen the young bull moose, one of the two owned by our late Governor-General, the Marquis of Lorne, harnessed to a carriage; but, although he could be induced to step out into a pretty decent trot by a little forcible persuasion with the whip, he did not take kindly to the slavery and sometimes used to lie down with his neck at full stretch, to show his repugnance to the idea of being turned into a horse, a transformation scarcely possible in an animal so much resembling a gigantic ass. The male and female moose to which I have referred, have been taken to the Highlands of Scotland by Lord Lorne, but I am sorry to hear that the bull has died in his new home. No member of the deer family makes finer venison than does the moose. The flesh, notwithstanding its being somewhat coarse in grain, is juicy and tender, and has a rich gamey flavour; and the fat, which is abundant when the animal is in good condition, is beautifully clear and white. A delicacy, which only the moose hunter can enjoy, is the marrow from the shank bones cooked immediately after the animal has been killed. I shall finish my description of the moose with the following quotation from Parker Gilmore:—

"The Virginian deer, the fallow deer, the wapiti, and the red deer, are to me perfect in shape, graceful in their movements and ornamental to the landscape; but the moose, on the other hand, with his short, thick neck, asinine head, protruding eyes, heavy, broad ears, tremendous antlers, long, awkward, powerful legs and disproportionate withers, looking even higher than they are, from the mane that surmounts them, can never be considered by an impartial judge but an awkward and clumsy brute. Of all the ruminants of the American continent, the moose is the tallest. I doubt not that a stall-fed ox can be made to weigh as heavy, but not to attain the stature; and on this continent, as well as others, it is really a duty that the legislatures of the various states and provinces owe to the country at large to pass and enforce such laws as will prevent his annihilation."

In any section of the country in which the Virginian deer abound, moose are seldom present. It is said, and I believe truly, that the moose, large and powerful as he is, is unable to withstand the lithe and vigourous attack of the active and sharp horned buck of the smaller species. In the fall of the year, under the natural impulses incidental to

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the season, desperate battles take place between the males. These conflicts, however, do not as often terminate fatally as the struggles between the males of the smaller species, the broad, blunt horns of the great elk not being so well adapted to the purpose of inflicting dangerous wounds as the sharp-pointed antlers of the former.

The woodland caribou, (*Rangifer caribou* Aud. and Bach.) or reindeer, inhabits Labrador and northern Canada, and thence may be found south to Nova Scotia, New Brunswick and Newfoundland, the northern part of the State of Maine and Lower Canada, on both sides of the St. Lawrence; thence westerly in the country north of Quebec to the rear of Lake Superior. It never migrates towards the north, but makes its migration in a southerly direction.

The following is the description given of this deer by Audubon: "Larger and less graceful than the common American deer, body short and heavy, neck stout, hoofs thin and flattened, broad and spreading, excavated or concave beneath, accessory hoofs large and thin, legs short, no glandular opening, and scarcely a perceptible inner tuft on the hind legs, nose somewhat like that of a cow, but fully covered with soft hairs of a somewhat moderate length, no beard, but on the under side of the neck a line of hairs about four inches in length, hanging down in a longitudinal direction, ears small, blunt and oval, thickly covered with hair on both surfaces. Horns one foot three and a half inches in height, slender, one with two and the other with one prong, prongs about five inches long, hair soft and woolly underneath the longer hairs, like those of the antelope, crimped or waved, and about one to one and a half inches long. At the roots the hairs are whitish, then become brownish grey and at the tops are light dun-grey, whiter on the neck than elsewhere, nose, ears and outer surface of legs brownish, a slight shade of the same tinge behind the forelegs, hoofs black, and throat dull white, a faint whitish patch on the side of the shoulders, forehead a brownish white, tail white with a shade of brown at the root and on the whole upper surface, outside of legs brown, a band of white around all the legs, adjoining the hoofs, and extending to the small secondary hoofs, horns yellowish brown, worn white in places." This description is all very well, and in the main points correct. The rather arbitrary dimensions given of the horns are scarcely borne out, or corroborated

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by the practical naturalist known as the hunter. The horns measured by Audubon for this description were very likely those of a female, which are much smaller than the antlers of the male. Here, before you, are two sets of horns of the woodland caribou, both of which came from the vicinity of the Kakabonga Lake, above the Desert, on the Gatineau River. They are singularly dissimilar in appearance; and, from the size, I judge that both belong to male heads. I saw a pair of caribou horns some years ago in the possession of Mr. Hiram Robinson of this city, which were very much larger, more massive and wide spreading, and had many more and longer prongs than either of these. The height of a full grown woodland caribou is about four and a half feet, and its weight about three hundred and fifty pounds. Large bucks are occasionally met with nearly four hundred pounds in weight. The food of the caribou consists of mosses, lichens and creeping plants found in the swamps in summer, and in search of which, and certain grasses, it paws up the snow with its broad hoofs in winter. The flesh when fat is most delicious, but when lean it is dry and insipid. The skin when tanned, is made into moccasins, and in the raw state is used in the manufacture of snowshoes. It is fine, thin, tough and durable. The caribou is the fleetest of American deer. In galloping he makes most extraordinary bounds. As a trotter, the slow-going 2.15 horses attempting to compete with him would be simply nowhere. Like his useful congener—some authorities believe them to be of the same species—the reindeer of Northern Europe, the caribou is possessed of great powers of endurance, often escaping from the Indian hunters, after the fatigue and starvation inseparable from four or five days of a continued following-up hunt, When the hunted animal gets upon glare ice, over which he can trot at a rate double that of the fleetest skater, the hunter is obliged to give up the chase. The caribou is a shy and exceedingly wary animal, and most difficult to still-hunt; neither can he be successfully hunted in deep snow, he being enabled to go over its surface upon his broad, flat hoofs like a hare. So far as I have been able to learn, it is only time lost to hunt the caribou with dogs. The hounds might follow the scent, but they would scarcely ever be in at the death, as it is a pretty well known fact that dogs cannot drive them to water. They are, however, successfully still-hunted by Indians, and also by white hunters skilled

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in the craft. Large numbers of them are sometimes slaughtered when discovered swimming across a lake or river in their migrations. I have heard of a camp of Indians killing fourteen in a few minutes as they were crossing the River des Lièvres. The caribou is still to be found in considerable numbers on the last named river as close as sixty or seventy miles from its confluence with the Ottawa; also on the Gatineau River above the Desert, and in more limited numbers above Pembroke, in the neighbourhood of Black River, and on the shores of Lake Nipissing. They are also plentiful on both sides of the St. Lawrence, beyond Rivière du Loup, below Quebec, and are quite abundant on the northern shores of Lake Superior. While we have no historical record of the woodland caribou ever having been found in any considerable numbers on the south shore of the Ottawa, I think there can be little doubt of its having been quite plentiful in the past on the north side of the stream within a few miles of its banks. Strayed members of the family have been, to my own knowledge, seen on the south side of the Ottawa, one having been killed at L'Orignal about twenty-five years ago. In such cases they had evidently strayed from the north side, which has always been their natural habitat. The caribou migrates in herds of from ten, to one, two, and four hundred; and it is a notable fact that a concealed hunter, with the wind in his favour, if he does not show himself, has ammunition enough, a good rifle, and is the right man in the place, can slaughter a whole herd. Under ordinary conditions, the caribou is the most difficult to approach of all deer, but when accidentally encountered, under circumstances such as I have mentioned, the animals seem to be completely panic stricken and unable to make any attempt to escape.

The wapiti (*Cervus canadensis* Erxleben) is not only the most noble specimen of the genus in America, but by far the most beautiful and stately animal of the deer tribe in the world. No animal known to naturalists carries such a majestic and symmetrical set of horns. In this feature the wapiti far surpasses the great Sambur of India, and the red stag of the British Islands. A large male will weigh between eight hundred and one thousand pounds; the female, when full grown and fat, weighing upwards of seven hundred pounds. The form of this noble animal is exceedingly compact, strongly built and graceful; the

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only apparent drawback to its perfect beauty being the disproportionate shortness of the tail. A large stag wapiti stands seventeen hands high, equal to the height of a large horse. The colour is yellowish brown, verging towards a dark glossy brown about the head and shoulders, belly brown, and a yellowish-white patch on each hind quarter. The horns, however, constitute the greatest point of beauty in the Wapiti. Antlers have been frequently met with measuring upwards of six feet from the burr, around the beam, to the highest point, ornamented with four formidable brow antlers, two over each eye, each eighteen, and sometimes twenty-four inches long, curved upward and elegantly tapering and smooth at the points. The other prongs or tines range from one foot to eighteen inches in length and are nicely graduated to fine points, as if they had been artificially tapered and polished. The horns shoot upward with a graceful and commanding sweep, and are remarkable for the almost uniform regularity of their growth. The largest stag of the Scottish Highlands would appear but a mere fawn standing beside a peerlessly crowned full grown stag of Canada. The monarch of the Highland glens seldom reaches more than four hundred and twenty-five pounds in weight, while his giant American congener turns the scale at more than double that weight. The wapiti—long misnamed an elk—was formerly quite numerous in the Ottawa Valley. In contradistinction, to the caribou and the moose, he was found more generally—though not exclusively—on the southern shore of the river. One hundred years ago, these animals were still present in considerable numbers in the County of Carleton, the hard-wood forests of which were their favourite haunts. The horns of the Wapiti are still quite frequently turned up by the plough in the vicinity of the City of Ottawa. I have, when a boy, often found them in the woods around the Village of Richmond, lying upon the surface of the ground, in such a fair state of preservation as to clearly indicate that not very long before those majestic animals must have been natives of our immediate neighbourhood. This specimen of a wapiti horn, which I now show you, was found near Eastman's Springs, in the Township of Gloucester; and, about eight years ago, a much larger and more perfect fragment was found on the farm of Mr. Robert J. Hinton, within two miles of the city limits. Both of these specimens, and others which I have seen, by

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their size, indicate that the wapiti of this part of Canada reached the largest size attained by the species. Many naturalists imagine that the last occurrence of the wapiti in this neighbourhood dates back to a period comparatively remote. This, however, is not the case, as facts, more conclusive than even the finding of their horns, can be adduced in proof of those animals having been numerous here less than one hundred years ago. Mr. Rice Honeywell, one of the earliest settlers in this region, positively affirms that within the last seventy years, he has seen the wapiti both alive and dead on the old Thompson farm, within four miles of the City of Ottawa. Mr. Honeywell knows well the difference between a wapiti and a moose, as he frequently saw many of the latter in the same locality. This brings the period of the existence of the wapiti in this locality closer than has been generally supposed. The wapiti can be "still hunted" successfully, being less vigilant and much more easily approached than any other variety of deer. In the North-West the Indians ride in amongst them, keeping well down on the necks of their horses, and thus frequently succeed in killing a herd of eight or ten in a few minutes. A wounded wapiti is a dangerous animal to approach unprepared, as many a hunter has found out to his cost.

The cutting down of the forests, the progress of settlement and the resistless march of civilization have driven these noble animals out of their old haunts. The race in this neighbourhood was by no means exterminated, for there were then but few hunters, and the appliances of slaughter were of a much more primitive description than the arms of precision of the present day. Rifles in Canada were unknown in the days of the wapiti, and the weapons of the Algonquin, the Iroquois and the Abenakis were then the bow and arrow. Like the Indian himself, with his war-paint and scalping knife, the wapiti, before the aggressive strokes of the axe, has had to travel towards the setting sun, and he is now only to be found in Canada, in any great numbers, in the country around the north and south forks of the Saskatchewan. Parker Gilmore, a famous sportsman, and a naturalist of no mean order, says: "I do not think, from the information I have been able to obtain from searching old authorities who have written on the fauna of North America, that the range of the wapiti ever extended eastward to the

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Atlantic seaboard; but that their habitat commenced with the prairie country, say Illinois or Indiana. However, these States have long ceased to know them; for, like other large game, they have rapidly retired before the tide of immigration. The upper waters of the Missouri and the plains around the forks of the North and South Saskatchewan, are where, at present, this mammoth stag will be found most abundant." The stag of Canada, like the caribou, is essentially gregarious, the herds frequently numbering hundreds. Those truly grand animals, year after year, are growing scarcer. The skin-hunter and the repeating rifle are doing their deadly work amongst them; and the time will shortly arrive, if legislatures in Canada and the United States do not forthwith grasp the required work of protection with a strong and relentless hand, when this stately ornament of forest and prairie shall have left his last shed antlers to tell the people of no distant day of the folly and improvidence which deprive them of a woodland glory of which any country ought to be proud.

The virginian, or red deer (*Cariacus virginianus*, (Bodd.) Gray), our common species, is one of the most graceful and beautiful of deer. Generally speaking the males only have horns. I have seen, however, within the last three years, two does brought to the Ottawa market each of which had horns somewhat resembling the antlers of a spike-horned deer, and although the time was late in the season the velvet still remained on the horns. These are the only instances in which I have noticed horns on the female of this species. In form the virginian is the most elegant of all the North American deer. The following correct description is from Billings' "Canadian Naturalist and Geologist":—"It has a long, tapering, pointed head and large lustrous blueish black eyes. The legs are slender and well formed, and in proportion to their size possessed of prodigious muscular strength, while the body is moderately stout and flexible. The horns are not large, but they are well armed with strong and sharp spikes. They are, near the base, bent backwards and in the upper part turned forward. They are usually cylindrical, but they are also sometimes met with a good deal palmated. They vary much in size and shape in different individuals. The prongs are round, conical, sharp and directed upwards. Situated partly on the inside of each horn near the base there is a short brow antler on most

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of the specimens. A large pair of horns weighs about six pounds, but there are few over four or five pounds in weight." "The colour of this animal varies with the seasons; in the autumn and winter it is blueish gray; in the spring reddish, becoming blueish in the fall. Beneath the chin, throat, belly, inner side of legs and under side of tail white. The fawns are at first red, and spotted with white along the sides. In the autumn of the first year they lose the white spots, and thereafter are the colour of the old ones. The hair is flattened and angular, that upon the under side of the tail long and white. The average length of this species is, from the nose to the root of the tail, five feet four inches, length of the tail without the hairs, six or seven inches, with the hairs upwards of one foot. The females bring forth in May or June, one or two, rarely three at a birth."

Occasionally specimens of this deer are found of a pure white colour, with the pink shade in the eye denoting the albino. I have seen two or three marked with irregular patches of white on various parts of the body. On one occasion, a few years ago, I shot a fine buck at Hemlock Lake, in the County of Ottawa, in the skin of which white hairs predominated so much as to give the animal quite a white appearance. A large doe was brought down by another of the party on the same day with precisely the same peculiarity. A few years ago Mr. Neil Morrison, of this city, had a magnificent white buck carrying a fine pair of horns. As a *lusus naturæ* in the animal creation, of extraordinary elegance and beauty, this lovely specimen was unrivalled. The pure and uniform whiteness of his skin was almost beyond belief. This rare and valuable specimen was caught in deep snow, when almost three years old, about thirty miles up the Gatineau River. It afterwards came into the possession of the Hon. R. W. Scott, who kept it with a number of red deer in a park for some time, where it ultimately died. If a deer be killed in water during the interval of the red coat, say from June until the middle of August, the carcase will sink to the bottom. At all other seasons the dead body will float. From recent accounts given by sportsmen in *Forest and Stream* and in the *American Field*, we learn that the largest male of the virginian species has been found to weigh something over three hundred pounds gross weight; while in the latter journal of January 16th, 1884, it is stated by Mr. Cyrus Butler, of

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Anna, Illinois, that: "The virginia deer of the Pacific States are smaller than those of the same latitude in the Central and Eastern States; and I do not think that the deer of Texas will average more than one half of the weight of the deer of Wisconsin and Michigan. From all I can learn on the subject it seems that the virginian deer of the Western States are smaller than those of the same latitude in the Eastern States; and it is certainly true that the further south we go the smaller we find the deer." A beautifully formed variety of this species is called the "spike-horn." This lovely animal, although identical in colour and habits with the branching-horned type of the species, is much rounder, shorter and thicker in body, and has a more elegantly shaped head. The true spike-horned deer has straight, sharp antlers, from six inches to a foot in length, setting backwards like the horns of the African oryx, which renders him a formidable and generally victorious antagonist in the periodical combats which take place between the male knights errant of the deer tribes. These conflicts are often desperate and protracted. I have seen a space in the woods fully one quarter of an acre in size, after a light snow in November, all trampled over, the soil torn up, and small dead trees uprooted in all directions, as the evidences of one of these fierce battles of chivalry. I was told by a "still-hunter," on the Madawaska River, who killed one hundred and fifty deer in one season, (how is that compared with the milder and less sanguinary mode of dog hunting?) that during the same year he came upon two large bucks in the act of fighting, and getting easily within thirty yards, killed both. In such conflicts the animals occasionally get their horns interlocked beyond the power of extrication, and both die of starvation as a rule. I have seen two heads interlocked, facing each other, so tightly that a strong man could not separate them. I am indebted to Mr. James Fletcher for a copy of the *London Field*, containing the photograph of a head of the most extraordinarily shaped horns which I have yet seen. The same paper contains another photograph of two heads with the horns interlocked together, side by side, while fighting. They were fastened to each other in such a firm manner that nothing but the shedding of the horns could have freed them. When found the prisoners were alive and in good condition. In both cases the animals were of the virginian species. This beautiful deer is found

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in all parts of the valley of the Ottawa, and between the Ottawa and St. Lawrence, in such places as the hardwoods and swamps are large enough to afford them shelter. They roam through the hardwoods and hemlock ridges in summer; and establish their yards, if possible, in a tamarack swamp in winter. About thirty years ago I saw a deer yard stretching from Bearbrook away beyond the Castor River, in the Township of Osgoode. It must have been, at least, four miles square, and must have contained hundreds of deer. This yard was completely intersected by paths branching off in every direction, and beaten hard enough to carry a horse. Deer yards may be found in the same section of the country still; but like the red-skinned herds of woodland beauties which formerly made the wilderness glorious, they have been perceptibly growing smaller and smaller, and a well beaten deer yard of ten acres in extent within twelve miles of Ottawa is to-day no mean representative of the widely trodden haunts of the virginian deer in the near past. The multiplication of hunters, superinduced by arms of precision, and the expertness acquired by practice in volunteer companies—but above all, the lawless assassins who slaughter them, male and female old and young, on the crust during deep snow—have tended, legally and illegally, to do more than decimate the magnificent denizens of the forests surrounding the City of Ottawa. The unavoidable clearing away for agricultural purposes, and the culpable destruction by bush fires of the forests in many places, have driven the deer back to more, distant haunts. The wolf too, although not a bit more sanguinary in his destructive instincts than the lawless crust hunter, has done his share in thinning out the deer in the valley of the Ottawa. Still, it is astonishing to know that, notwithstanding all these adverse influences, there are yet large numbers of them on both sides of the Ottawa River, and in the forests bordering upon its many large tributaries. In summer the virginian deer delights to hang around clearings for the purpose of feeding on grass, clover, turnips and potatoes. In former times many of them were killed from scaffolds by night watchers in turnip and potato fields. I have not time to give a description of the various modes of deer hunting. As a sportsman, I would scorn to refer in a descriptive manner to fire hunting or crust hunting. Of the two legitimate methods, still hunting and hound hunting, I prefer the latter

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on the runway system, as less destructive and more lively and full of sport than the former. To me, with the glorious music of the dogs ringing and re-echoing through the woods, there is more genuine sport and more true skill required in striking a buck on the "full jump" with a single bullet than in doing the same thing in any other style.

No hunter with whom I have spoken, nor any book which I have read, has given me a satisfactory account of what becomes of all the cast off horns of our common deer. I am aware of their being gnawed and eaten up by mice and other rodents; but during the period when the horns are falling off, from the first to the sixth or seventh of January, it is a very rare occurrence to find the horn of a deer, and much more unusual to discover both horns together. Some of the knowing ones say that the deer buries his horns, others that he drops them in water, and others still, that the does eat them. No proof has, however, been adduced that any one of these conjectures is correct. Although it is a common thing to find the shed antlers of the wapiti on the prairies and in other places, the whereabouts of the cast off horns of the virginian deer has not yet been discovered. This is a point in natural history upon which we still want light. It is a strange and mysterious provision in the economy of nature that the periodical growth of a deer's horns—even the ponderous antlers of the moose or the wapiti—should involve only an extracrdinary forcing process of little more than four months. Shortly after the dropping off of the horns the new ones begin to appear. The growth is slow at first until the setting in of the warm spring weather, when it is exceedingly rapid. About the middle of August they are full-grown, when they are covered with a soft, velvety skin, which the animal gets rid of by rubbing them against small trees, never against large ones. About the first of October, sometimes earlier in the season, the velvet has disappeared, and the new antlers may then be seen in all their hardness and beauty. The animal may then be said to be in his finest condition and at his heaviest weight. A male *Cariacus virginianus* is seldom seen on the first day of January with his horns on, and never that I am aware of, after the fifth of the same month. It is a well known fact, however, that the moose does not lose his horns until later in the season. I have seen the head of a moose killed in January of the present year with horns still on, and

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without any appearance indicating their likelihood to fall off. Here, I imagine, is the proper place to refer to some strange peculiarities and diversities in the horns of the common deer. It is difficult to account for the abnormal growth so frequently visible in the antlers of these animals. Some naturalists seem to think that such irregularities of growth have been occasioned by injuries received by the horn when in its soft and pulpy state. If such were the case, would it not be natural to conclude that after the deformed member had been shed, the new horn would assume its natural and normal shape? This cannot be said to be so. This head which I now show you, as you may observe, is one of the most singular formation; and from personal observation, I know that the splendid animal that carried this strangely abnormal pair of horns, wore his crown in its present shape year after year. I had a fair open view of this deer the year before that in which he was killed, near the spot where he was shot, and I particularly remarked this singular looking horn growing out on the right side of his head. Here, also, are two fine heads each with backward lateral prongs of a style seldom seen. Both have been taken from old and heavy deer. Abnormally shaped horns, as far as I know, are rarely, perhaps never, seen except in deer of great size and age. This is my experience. I have frequently seen very old bucks of the virginian species with immense curved beams with only one or two blunt and worn looking prongs on either side, and others of similar size and form with only rudimentary protuberances, indicating, as it were, where, in the horns of former and more vigourous years, the prongs that had been accustomed to grow. Although usually so, it is not always the largest deer which carries the largest horns. The heaviest and largest deer I ever saw, had the most miserable set of attenuated antlers I have ever seen on a full grown deer. On the other hand, one of the heaviest pairs of horns, which have yet come under my notice, was taken from the head of a buck of not more than one hundred and fifty pounds weight. This pair which I now show you is perhaps the largest and most beautiful that any one present has seen. The animal from which they were taken was shot many years ago on the Castor River, in the Township of Osgoode. They belong to Mr. W. H. Baldwin of this city. They are singularly regular in shape, and, at the same time, strangely irregular and unlike the ordinary antlers of the

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Cariacus virginianus. To a certain extent they are palmated and evidently grew upon the head of a very old deer, which I have been told was a complete skeleton, with his teeth nearly all gone, at the time he was killed. Perhaps some gentleman present may be able to enlighten us upon the question of abnormal horns. In telling you the story of what I have learned myself about the deer of the Ottawa Valley, I have aimed at telling it in a manner likely to interest the greater number. I have endeavoured to avoid abstruse technicalities, and above all I have unwillingly been compelled to curb my inclination to tell you the thrilling story of many a glorious run, and rehearse the tale of many a night of killing happiness around the camp fire, where battles were fought over again and memory hung around us the branching antlers of many a woodland king, whose trophied heads can be found in more than one house of the dearly loved companions with whom I have so often pitched the tent in the wilderness. If I have succeeded in any measure in either instructing or interesting anyone in this audience, I shall proudly feel that I have not roamed the woods, stood upon the runway, listened to the deep and matchless music of the hounds, or drawn the rifle-trigger amid the mighty and sublime solitudes of nature in vain.

And now my pleasant task is done,
The fruits of many a glorious run!
Still springing 'mid the lambent haze
Which circles round the camp fire's blaze,
Revealing to fond memory's eyes
The dear, unrivalled days gone by,
When limbs were lithe and arms were strong,
And life one gladsome burst of song.
Revealing 'mid unfading sheen
"The Runway" in the forest green—
"The antlered monarch's" springing bound,
The matchless music of the hound!
When headlong on the steaming scent,
With instinct true as steel, he went,
The gaze into the spreading track—
The breaking twig, the rifle's crack,
The quivering limb, the closing eye,
The forest's dying majesty.

Dr. Baptie said that there had lately been a discussion in *Nature* tending to show that the deer ate their shed horns, and later he read some extracts giving evidence on this point.

Mr. W. L. Scott stated that the buck which his father had owned was *perfectly* white, and after being kept in a park for three or four

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years, died of some throat disease. He had seen heads of caribou at Mr. Allan Gilmour's with the horns coming down not only so as to hide the eyes but even to make furrows in the cheeks. Referring to the spike-horn deer, he alluded to the similarly antlered oryx of Africa as the only deer that attempted to resist the onslaught of the lion.

PROF. MACOUN said that moose were very plentiful on the Peace River in 1875, and that 8 lbs. of venison per man per diem was the ordinary allowance there. He described some experiences at Ste. Anne des Monts, when he had watched caribou, himself unobserved, and testified to their intelligence, their dainty habits and the affection shown between mother and offspring. He disputed Mr. Lett's distinction between pot-hunting and legitimate sport as illogical, and condemned both alike as appertaining to man's lower nature. He had seen shed horns of deer marked with the teeth of rodents.

DR. WICKSTEED enquired how the caribou was able to run on ice if its hoof was so spread as to enable it to run on light crust, as that spreading which was an advantage in the one case would appear to be a hindrance in the other.

MR. LETT explained that the rim of the hoof was sharp and pointed and cut well into the ice, the hoof being probably gathered together.

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REPORT OF THE GEOLOGICAL SECTION FOR THE SEASON OF 1883.

To the Council of the Ottawa Field-Naturalists' Club :

GENTLEMEN,—In presenting the third annual report the undersigned beg leave to state that during the past season a considerable amount of additional information has been obtained both in the palæontology and stratigraphy of the rocks, not only from the numerous immediate exposures within the city limits, but also from those even in more remote parts.

New localities were visited, where valuable points in stratigraphy were noted and collections of the organic remains made, giving such evidence as will greatly assist in ascertaining the true horizon of the rocks in question.

A goodly number of workers have joined our ranks, and it is indeed pleasing to note the results already obtained. The zeal and earnestness manifested in the numerous "hunts" held were very encouraging. To summarize the work done in each formation systematically the notes will be given under their proper heads.

POTSDAM FORMATION.—The typical exposure of this series of conglomerates and quartzites, resting unconformably upon the upturned edges of the Laurentian rocks, was again visited, and that upon the third of the general excursions of the Club, held at Buckingham, Que., the 2nd August, 1883. No definite organic remains were found other than the evidence obtained on a former occasion, viz., *Scolithus Canadensis ?* Billings. One of the leaders addressed the members present and described the line of outcrop of this formation skirting along the base of the Laurentides both in Canada and the United States, in which latter place these are represented by the hilly districts of the Adirondacks.

CHAZY AND BLACK RIVER FORMATIONS.—During the season of 1882–83 the lower measures of the Chazy were observed and reported on as occurring at Pointe des Chênes, a little below Aylmer, Que. The same series was further investigated during the past season and new evidence obtained. Aylmer, Que., and Britannia, on the Ontario shore,

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are both built on this formation. To the north of Aylmer, overlying the sandstones, whose thickness is evidently not far from 100 feet, are to be found beds of a transitional nature. They are only a few feet thick, very dark in colour, brittle in texture, and apparently unfossiliferous, with innumerable joints and cleavage planes running in all directions. These are immediately followed by beds of compact greyish limestone holding orthoceratites in abundance, four or five feet above which other beds hold in great profusion the well known *Stromatocerium rugosum*, Hall—a sponge or sponge-like organism. Regular colonies of these fossils are to be seen occupying considerable patches in the fields on the north concession road. These beds have a very slight inclination to the north, with an almost due east and west strike. Following these measures at right angles to the strike numerous Chazy fossils were collected. That very characteristic band of impure friable limestone holding abundance of *Leperditiæ* was found. (See Decade III, Geol. Surv. Can., page 92.) Then following in a north-easterly direction, at some 2½ miles from Aylmer, numerous species of fossils characteristic of the Black River formation fauna were obtained. Much work still remains to be done in this neighbourhood, as the rocks are highly fossiliferous and the specimens in many instances very well preserved. Nineteen species of fossils were collected from these beds. Much credit falls to Mr. E. T. W. Sowter for the work he has already accomplished in these interesting exposures.

Trenton Formation.—The very numerous and highly fossiliferous exposures of this formation about Ottawa, from which the late Mr. E. Billings, the late Dr. Van Cortlandt, and many members of the Field Naturalists' Club obtained a splendid series of fossils—a typical collection of which is to be found in the Museum of the Geological and Natural History Survey—proves still a rich hunting ground for the palæontologist.

During the past season a fine exposure was observed within the Rideau Hall grounds, where an interesting collection of fossils was made, amongst which were *Iocrinus subcrassus*, Meek and Worthen; *Lichenocrinus crateriformis*, Hall; a *Discina* like *D. Circe*, Billings; and about twenty additional species characteristic of Trenton age.

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Another crinoid locality was found at the vacant lots on Sussex street below Messrs. Hamilton's offices, where *Heterocrinus Canadensis*, Billings, a form closely related to *H. simplex*, Hall, was found in abundance and in a good state of preservation.

UTICA FORMATION.—Additional researches were carried on during the past season in this formation, but the notes thereon are reserved for a subsequent report.

POST-TERTIARY DEPOSITS—*(Marine, Fresh Water and Human Remains).*—In the Leda clay, Saxicava sand and fresh water marls of the country adjoining Ottawa, as well as in the numerous and extensive deposits of boulder drift, etc., a vast field of special enquiry is open to the observer. In the Post-Tertiary history of our rocks we have to hail a new era in its researches. At Casselman, Ont., where the Club held one of its excursions, numerous *archæological* specimens were discovered in the shape of *pottery, bones*, and other remains. Although the pottery was broken into bits ranging from half an inch to four inches in diameter, still the various designs and patterns peculiar to the tribes of the great Algonquin family, who once inhabited the eastern portion of North America, are quite characteristic.

The sherds were found buried, beneath the sod close by a young hardwood forest on the eastern shore of the South Nation River, at the foot of a rapid, to a depth ranging from three inches to two feet, mixed with bones of beaver, bear and deer, remnants of the chase, together with charcoal and ashes, all plainly indicating the existence of some ancient village inhabited by a tribe of Indians whose customs and manners were not unlike those who dwelt at Hochelaga at the foot of Mount Royal when Cartier first landed, some three hundred years ago. A *gouge* and an *adze* had been found some seventeen years previously by Mr. J. S. Castleman at the same locality, but no more researches had been carried on since that time in this treasury of archæological remains until the Club's excursion there. The pottery remains, together with the adze, gouge and bones, are at present in the Museum of the Geological Survey.

Mr. Walter R. Billings notes that during the past season he has examined the exposures of the *Trenton* formation on Division street, in

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Rochesterville. There he found good examples of fossil sponges, which at first sight Mr. Whiteaves referred to the genus *Calathium*. They require microscopic investigation before they can be referred to their proper places.

The following species of unusual occurrence in these rocks are recorded by Mr. Billings: *Astylospongia parvula*, Billings; *Receptaculites occidentalis*, Salter; *Petraia corniculum*, Hall; *Pasceolus globosus*, Billings (a smaller variety); *Amygdalocystites florealis*, Billings; *Agelacrinites* resembling *A. Billingsi*, Chapman; *Glyptocrinus ornatus*, Billings; *Archæocrinus*, n. sp.; *Calceocrinus inæqualis*, Billings; *Hybocrinus conicus*, Billings; *Dendrocrinus proboscidialis*, Billings.

HENRY M. AMI.

17th January, 1884.

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REPORT OF THE BOTANICAL BRANCH.

To the Council of the Ottawa Field-Naturalists' Club:

The work in this branch has been vigourously prosecuted throughout the past season, which, contrary to all expectations, was later than usual. The latter part of April was very cold, with snow on 27th. It was not until May that any work could be done in the field. Soon after their election your leaders made preparations for work by organizing working parties and sub-excursions; the result having been an addition of new species to the Flora Ottawaensis. The botany class conducted by the ex-President was turned into a summer class. This new feature proved to be useful, and was the means of inducing several members to join the Club. It has been continued during the past winter and has been most successful, the average attendance being sixteen at each meeting, and the attendance on one occasion reaching to twenty-eight. Collections were made at all the regular monthly excursions of the Club. The first one on 26th May to the Chelsea Mountains enabled the members to add the beautiful and distinct *Viola Selkirkii* to their collections. At this time also good specimens of *Triosteum perfoliatum, Carex platyphylla, Asplenium Trichomanes* and *Camptosorus rhizophyllus* were collected, and a few specimens of the curious lichen *Umbilicaria Dillenii* were found on the top of King's Mountain. Interesting biological specimens of *Trillium grandiflorum*, showing a transition from the petaloid form to the foliaceous leaves in the flower, were collected by Mrs. Chamberlin. One specimen had three white petals with green stripes down the middle, and one of the petals was developed into a leaf like those of the whorl of leaves proper. Another had an extra leaf half way up the pedicel and one of the petals foliaceous. Several specimens of the greenish-yellow variety of *T. erectum* were found at Stewarton in May. It is much to be regretted, from a botanical standpoint, that Stewart's bush, at Stewarton, is being so rapidly cleared. Only six years ago this bush was one of our richest hunting grounds; but now, where it was almost an impenetrable wood, it is almost cleared of underbrush and the grasses have formed in many places a sward beneath the trees. This was one of the localities for *Calypso borealis*, and also the only near one for

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Dicksonia punctilobula. The excursion to Casselman was the means of adding no less than nine species to the flora, some of which deserve special mention. *Hypericum pyramidatum*, *Plantago Rugellii*, *Phlox divaricata*, *Saururus cernuus* and *Botrychium lanceolatum* were the best finds. The last named is a rare moonwort and the two preceding are unexpected discoveries in this part of Canada.

The Mer Bleue has again proved to be a rich locality. Here in the beginning of July several fine specimens of the beautiful orchid *Arethusa bulbosa* were found. In a patch of fourteen growing together eight had well developed leaves like *Calopogon pulchellus*. A remarkable feature of all the specimens found on this occasion was their light colour. At a few yards' distance they could not be distinguished from *Pogonia ophioglossoides*, amongst hundreds of which lovely flowers they grew. The usual colour of the arethusa is a much more intense shade of red. On the same day were collected fine specimens of undoubted *H. fimbriata*, and near the railway station *Calamagrostis Langsdorfii* and a grand clump of *Carex folliculata* were discovered. On the Chaudière Islands *Prunus pumila* was found in flower in June, and in the autumn *Helenium autumnale* was plentiful. From Templeton *Thalictrum purpurascens* is reported and from Buckingham *Carex Grayii*. Several good carices have been added. The well marked variety *latifolia* of *C. laxiflora* was found at Stewarton in company with *C. pallescens*. *C. sychnocephala*, a rare species only previously collected in Canada by Prof. Macoun, was collected at Billings' Bridge on the last sub-excursion of the branch in September; also good specimens of *Diervilla trifida* in fruit. At Malloch's Bay, *Gratiola aurea*, *Ranunculus multifidus*, *Hippuris vulgaris* and *Mentha Canadensis var. glabrata* were found. Hull also produced its contributions to the lists. *Solidago neglecta*, new, and two fresh localities for *Pellæa gracilis* and *Camptosorus rizophyllus*. *Physalis grandiflora* and *Riccia fluitans* were also collected here.

Riccia natans was found at Deschenes and at New Edinburgh. At Gatineau Point *Osmorrhiza longistylis* was collected by Miss Isabel Grant, and to this lady the committee have very much pleasure in awarding the botany prize for the year. Her collection is exceedingly well mounted and preserved, and comprises 185 species. She has suc-

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ceeded in discovering the type of *Solidago cæsia*, from which we find that all the records for Canadian localities of this species refer to the variety *axilaris*. This, then, is not only new to this locality but to Canada. Miss Grant also collected a *Stellaria*, which Prof. Macoun considers to be *graminea*, a European species only previously detected by himself during the past season in the Lower Provinces. Among rare species already recorded from this locality, but which have been again collected this year, *Typha angustifolia*, *Cypripedium arietinum*, *Cyperus phymatodes* and *Carex lenticularis* may be referred to. The last named has only been found on the sandy shores of Duck Island (17th October), where were also found earlier in the year *Carex squarrosa*, *C. monile* and *Juncus filiformis*. *Nasturtium amphibium* is found in many places round the city in low ground flowering in June. *Asperugo procumbens*—several luxuriant specimens of this plant were collected along the banks of the Canada Atlantic Railway at Mount Sherwood.

Amongst aquatics some important observations have been made. In last year's report reference was made to a variety of *Potamogeton pusillus* which the Rev. Thomas Morong had pronounced as very similar to the Sicilian variety *panormitanus* of Bivorni. During the past season a fuller suite of specimens has been sent to Mr. Morong by Mr. Fletcher, the finder, and he now writes with regard to them: "I "have carefully compared your plants with those sent me as *P. pusillus*, "*L. var. panormitanus, Biv.*, and can see no essential difference. In "my specimens the submerged leaves are shorter than in yours; they "are not ruddy at all, and none volatile. The description of the "variety, however, corresponds. 'Leaves longer (than the type), more "'flaccid, the upper flowering ones opposite and spathulate, the whole "'surface of the leaf, with a pretty chain-like areolation surrounded "'near the margin with a ring of denser substance.' I am sure that "your plant meets this description, and when compared as to the "flowering leaves the specimens agree. I should not, however, regard "it as a distinct species, since it bears so many of the characteristics of "*pusillus*. The ruddy tinge and revolute leaves may be owing to the "season or accidental circumstances; but I would watch and see if "these are permanent characteristics. The detection of this variety in

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"your locality is particularly interesting as it has not before been "found in America."

With regard to the parasite fungus infesting the leaves of various species of potamogeton, Prof. Farlow at special request has kindly prepared a detailed note of the species, which is appended to this report. This note, coming from such a high authority, is of special value.

Among the latest collections of the year were: Sept. 8, *Aster acuminatus*, at Stewarton; Sept. 23, *Epiphegus Virginiana* in flower. Growing associated with this were found the seed pods of *Corallorhiza multiflora*. In a small beech wood near St. Louis Dam. Oct. 20, *Hamamelis Virginica* in full flower. All of these, although quite abundant where they occur, are very local, only a single locality for each having so far been observed.

On Oct. 27 the bottom of the Rideau Canal, near the Bank Street Bridge, was found to be covered with enormous quantities of a species of nostoc. The plants were round like marbles, and of a deep green. They were generally single; but occasionally double specimens were found, in which case one was smaller than the other. The size varied from that of a small pea to one inch in diameter.

In conclusion, the leaders would suggest to the members the advisability of each one taking up the study of some particular family of plants and making a specialty of it, and they are convinced that if this is done valuable results will follow. Prof. Macoun studying the fungi in this way discovered during last autumn in this locality no less than eight species new to science.

They would also draw attention to the great advantages which are to be derived from cultivating plants from the seed and examining them closely during their different stages of growth. Anyone who has a garden at all can cultivate a few species, and many can even be grown in flower-pots in a window. A large number of plants have been grown during the last three years from seed received from our corresponding members, particularly from Mr. Hill, who is in British Columbia, and many rare plants have thus been examined, and have had paintings made of them by Mrs. Chamberlin. Some which have thriven particularly well, flowering freely and ripening their seeds are: From British Columbia, *Lewisia rediviva* roots received in 1881 bore

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last season from two to five flowers and ripened seed; *Sedum spathulifolium* increases rapidly and is very hardy; *Helianthus lenticularis* grows luxuriantly; *Phacelia Menziesii*, *Astragalus lotiflorus*, *Chrysopsis hirsuta*, *Cirsium undulatum*, *Grindelia speciosa* grow luxuriantly and ripen an abundance of seed. The following have grown well but have not flowered yet: *Pentstemon Lewisii*, *Elæagnus argentea*, *Rubus Nutkanus*, *Ericoma cuspidata*, *Fritillaria lanceolata*, and *F. pudica*, *Allium cernuum*, *Lupinus sericeus*. From the North-West: *Petalostemon violaceus*, *Lepachys columnaris*, *Solidago rigida*, *Monarda fistulosa*, *Bontelona curtipendula*. All of these would make valuable additions to our flower gardens. It is hoped that before long we shall have Government experimental stations where the suitability of certain plants to different districts can be tested; but in the absence of these the members of this Club can do valuable service for the country by growing and carefully observing desirable plants. Moreover, many botanical descriptions of species have been drawn up from dried specimens alone, and in this way occasional errors have crept in. Now, if by growing a great many plants we can correct even a single one of these errors we shall not only do good work for science but thus a lasting honour will be conferred on the Club.

J. MACOUN,
R. B. WHYTE,
J. FLETCHER,
Leaders.

31st January, 1884.

FLORA OTTAWAENSIS.

(*Additions made in 1883.*)

Thalictrum purpurascens, L., L'Ange Gardien, August, 1882 ..... Mr. Ami.
Nasturtium amphibium, Rochesterville, June, 20.... Mr. Fletcher.
Viola Selkirkii, Pursh, Chelsea Mountains, ... "
" *tricolor, L. var. arvensis, Ging*, Mount Sherwood, June 1 ..... "
Hypericum pyramidatum, Ait. (leaves) Casselman .. "
Stellaria graminea, Casselman ..... Miss I. Grant.
Prunus pumila, L., Chaudière Islands, June ..... Mr. Fletcher.
Thaspium aureum, Nutt. Casselman ..... Miss I. Grant.
Solidago cæsia, L. (type), Billings' Bridge ..... "

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Solidago neglecta, Ironsides, July 20.....Mr. Fletcher.
Rudbeckia laciniata, Casselman..... "
Campanula dracunculoides, Sparks Street, June..... "
Plantago Rugellii, Casselman ..... "
Linaria vulgaris, Miller, (Peloria state) Stewarton, August, 1882..... "
Mentha Canadensis, L. *v.* glabrata, Gray, Malloch's Bay..... "
Hydrophyllum virginicum, L. Casselman.....Mr. R. B. Whyte.
Phlox divaricata, L., Casselman.....Mr. Fletcher.
Saururus cernuus, L., (leaves) Casselman..... "
Fagopyrum Tartaricum, Metcalfe Street, June 20... "
Quercus bicolor, Willd, Casselman..... "
Potamogeton amplifolius, Meech's Lake..... "
" pusillus, L. *v.* panormitanus, Biv. Rideau Canal, June 28..... "
" lucens, L. *v.* Minor, Nolte, Meech's Lake..... "
Arethusa bulbosa, L., Mer Bleue, July 2..... "
Carex laxiflora, *v.* latifolia, Stewart's Bush, June 15. "
" pallescens, Stewart's Bush, June 15..... "
" sychnocephala, Carey, Billings' Bridge, September 24..... "
" tenuiflora, Wahl., Lake Flora, Hull, June 20.. "
" folliculata, L., Eastman's Springs, July 2..... "
" Grayii, Buckingham, July 2.....Mr. Ami.
Calamagrostis Langsdorfii, Mer Bleue, July.....Mr. Fletcher.

APPENDIX A.

NOTES ON A FUNGUS PARASITIC ON SPECIES OF POTAMOGETON.

W. G. Farlow, Prof. Harvard University.

In November, 1882, I received from Mr. J. Fletcher some seeds of *Potamogeton Vaseyi* collected in August, 1882, near Ottawa. A microscopic examination of the seeds showed them to be filled with a curious fungus growth, which I thought might probably be placed in the order *Ustilagineae*. As the material sent was preserved in alcohol, it was, of course, impossible to ascertain how the spores of the fungus germinated, and unfortunately, in the *Ustilagineae*, it is often necessary to know the mode of germination before referring a form to its proper

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genus. The fungus seemed to me to be closely related, at least, to the genus *Sorosporium*, and I sent some of Mr. Fletcher's material to M. Woronine, at that time residing in Paris, and the author of the valuable paper on the development of *Ustilagineae* which had appeared a few months before. M. Woronine replied that he did not himself recognize the parasite, but on showing it to Dr. Maxime Corun, of the Jardin des Plantes, he recognized it as closely related to a form growing on *Alisma Plantago* which he had made the type of a new genus *Doassansia*. In a letter Dr. Corun, supposing that the fungus had been collected by me, stated that he had named the species *Doassansia Farlowii*, and, as his paper in which the species was mentioned had already gone to press, my letter stating that the fungus had been found by Mr. Fletcher, and not by myself, was received when it was too late to change the name.

Dr. Corun's paper appeared in the Annalls des Sciences, 6 Série, Tome 15, bearing the date June, 1883, but the paper was not received in this country until several weeks later. The description of our plant is there given as follows: "*D. Farlowii* sp. nov., *soris ovalibus compressis numerosis, ovarium Potamogetonis cujusdum totum occupans; sporae.* Le diamètre des sores oscille pour le diamètre longitudinal entre 0^{mm}, 2 et 0^{mm}, 18; pour le diamètre transversal, entre 0^{mm}, 18 et 0^{mm}, 14. Le diamètre des spores, non mûres, parait être de 0^{mm}, 02." Prof. DeBary, to whom M. Woronine communicated preparations of the American fungus recognized it as the same as that described and figured in Hoffmann's Icones analytical fungorum, p. 69, Tab. 16 f. 3 as *Sclerotium occultum* found in the fruit of *Potamogeton lucens* and *P. natans*.

Before the receipt of Dr. Corun's paper, I gave a short account of the fungus in the *Botanical Gazette*, of August, 1883, which it may be well to quote in this connection. "The fruit of the *Potamogeton* was swollen, and a section showed globular masses scattered through the substance of the fruit. The masses consisted of densely packed cells, the outer layer of which was darker coloured than the rest and regularly arranged, so that the cells, which had the shape of short cylinders with rounded ends, had their longer axis always in the direction of the radius. Beneath this regularly arranged layer the cells were roundish-angular and presented the appearance of parenchymatous cells."

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It will be seen that this curious fungus hitherto unknown in America was first described by Hoffmann, the date of the Icones being 1863, but it was not, however, recognized by him as belonging to the *Ustilagineae*, to which it seems to be correctly referred by Corun. If we are to follow the system of nomenclature in vogue on the continent the species would be called *Doassansia occulta* (H. Hoffm.) Corun. The genus as characterized by Corun is marked by the fact that the external cells of the sori remain as a sterile covering, while the internal cells on the rupture of the sori give off short germinal tubes, which bear at their tips whorls of short cells as in the genus *Tilletia*. The germination was seen by Corun in *D. Alismatis*, a species which has also been found recently in the United States. As I have said, the material first sent by Mr. Fletcher in 1882, was in alcohol, and the germination could not be seen. In 1883, I received some fresh material from Mr. Fletcher, but at the time of sending the spores were not mature, apparently, and I was unable to make them germinate. If the form on *Potamogeton* acts similarly to that on *Alisma*, it ought to be an easy matter for observers in Canada to discover the mode of germination. According to Corun it is only necessary to place the ripe sori of *D. Alismatis* in a damp place, when they quickly split open and the internal cells at once give off the characteristic germinal tubes. From the accompanying figure of a germinating spore of *D. Alismatis*, one can see what to expect from the form on *Potamogeton*.

D. occulta has also been found by Mr. Fletcher or *P. pusillus*, *P. perfoliatus* var. *lanceolatus*, and *P. natans* in Canada, and its range will perhaps be found to extend considerably southward. Besides the true species of *Doassansia*, already mentioned, a third form was doubtfully referred by me to the same genus in a paper in the *Botanical Gazette*, August, 1883. It forms small black spots in the leaves of *Epilobium alpinum* in the White Mountains, and may be expected farther north. Any collector so fortunate as to find it, should, if possible, watch the germination.

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REPORT OF THE CONCHOLOGICAL BRANCH.

To the Council of the Ottawa Field-Naturalists' Club:

In presenting their report, the leaders of the conchological branch regret that during the past season they were, for reasons unnecessary to mention, unable to devote much time to the collection and study of the mollusca of this vicinity. They have, however, to record the discovery of a species new to your lists and to lay before you a few observations on species already noted.

An important addition to the Club lists has been made by Mr. W. H. Harrington. With a view to obtaining very minute beetles, that gentleman collected in November a quantity of sphagnum and other moss in Dow's swamp. The moss when dried was shaken over white paper, and with the insects which fell from it were found a number of small shells. These he submitted to one of the leaders of this branch for determination. They were found to include a number of interesting species—some so rare as not to have been met with here except by Mr. Heron, and one altogether new. This is, we consider, *Patula asteriscus*, Morse. It is very distinctly characterized, and therefore not likely to be confounded with any other species. Although not hitherto known to occur in this vicinity, it has in Canada an extended eastern and northern distribution, having been recorded from Gaspé and the country north of Lake Superior.

Of the other shells found by Mr. Harrington, the most worthy of note are *Hyalina milium*, Morse; *Pseudohyalina exigua*, Stimpson; *Vertigo milium*, Gould; and *V. Gouldii*, Binney.

Mr. Harrington's success shows that the process of collecting and screening moss may be used with great advantage for collecting not only insects but minute shells.

That shells reputed to be rare may yet be very common is well illustrated by the fact that *Macrocyclis concava*, Say, was found in May last in great abundance in a prickly ash thicket on the banks of the Rideau in Billings' bush. Previously but a few isolated specimens had been found.

Succinea ovalis, Gould, occurred in considerable numbers on the banks of the brook flowing through the beaver meadow in Hull, about

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half a mile north of the Aylmer Road tollgate. They were large for the species and of a rich amber colour. Shells of equal size but paler on the body whorl and tinged with red towards the apex were found on the Ontario shore of the Ottawa near Mason's mill in company with *Succinea avara*, Say, and *Hyalina nitida*, Müller.

The young of *Succinea ovalis* were taken on alders in the Hull beaver meadow at the height of eight feet from the ground, where they were observed both by Mr. Harrington and one of the leaders of this branch. This climbing habit of a species which usually lives at the very edge of a pool or stream is not a little remarkable. *Succinea avara* has also been observed climbing to a height of three feet on tall fronds of *Struthiopteris germanica* in Billings' bush.

A *succinea* resembling *ovalis*, but smaller and more acuminate, was found in abundance on floating timber in Skead's Bay near the Remices Rapids in October, 1882. Specimens collected at that time were afterwards mislaid; and on a visit to the same place in October, 1883, no shells of the kind could be found. This locality should be visited again during the coming season and an effort made to collect some of these shells. A small form of *Limnæa stagnalis* is also found there and is of much interest.

In the report of the branch made in 1883 mention is made of the occurrence in a garden in this city of a single specimen of *Limax agrestis*, Linn. In the preceding years this slug was not observed either by Mr. Heron or Mr. Latchford. The garden in which one solitary individual was found in 1882 afforded hundreds in 1883. Last year in and around Ottawa *L. agrestis* was abundant everywhere, both alone and in company with the smaller and common native species, *L. campestris*, Binney.

L. agrestis is of foreign origin, but has long been known as inhabiting the cities along the Atlantic coast. Its migration has since been steadily inland; and its advent in Ottawa is of interest not only from a scientific but from an economic point of view, as it is an exceedingly prolific and voracious species. Gardeners have already complained of its destructive attacks on lettuce, spinach and other tender esculents, and its continued increase may be regarded with some apprehension.

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In the past year, as in the year previous, the water in the Ottawa never fell so low as to enable us to collect any of the fine unios which are known to occur down the river.

Undoubted specimens of *Sphærium securis*, Prime, were obtained in the culvert which crosses St. Louis Dam. On Mr. Heron's list this species is marked with a query.

Planorbis bicarinatus, Say, in the typical form was found on the right shore of the Rideau in the rapids near Hartwell's Locks. A small variety with the keels less developed and with coarse wrinkles was found in the pond east of the Bank Street Road near Billings' Bridge, and in brooks in Hull and Masham. Meech's Lake afforded two shells of this species of much greater size than any previously found, but of the typical form. The measurements of the larger shell are as follows: Greater dia. 0.83 in., lesser dia. 0.64 in., height 0.52 in. Both shells were unfortunately dead. They were found near the outlet of the lake. Living specimens will probably be had higher up the lake—a locality still unknown to us and worthy of a visit.

Very fine *Limnæa columella*, Say, were found in the early part of November in the bay above Mason's mill, at Mechanicsville. One specimen clung with such tenacity to the log on which it was observed that, while the empty shell came away in the collector's fingers, the animal itself remained adhering to its foothold.

On the 13th October a good find of *Campeloma decisum*, Say, was made in McKay's Bay, New Edinburgh. The shells, though not of so bright a green as those of the Rideau, are nevertheless of good colour, very large, and beautifully clean.

Two weeks later the same locality was visited, when no living shells were to be found, but numbers of fresh dead specimens were observed with the peristome broken where thinnest and portions of the animal extracted. Whether this was done by muskrats or birds could not be ascertained.

An effort was made during the past year to collect from as many different localities as were accessible large sets of our commonest shells, such as *Limnæa stagnalis*, *L. palustris*, *Physa heterostropha* and *Planorbis trivolvis*. Many forms of these protean species have been col-

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lected which present characteristics well worth noticing. Comparison of these varietal forms is, however, deferred until more material shall have been accumulated.

In conclusion, we would solicit the co-operation of the members of the Club who have not heretofore taken an interest in the study of our shells. So wide and rich a field as here presents itself should be worked by numerous earnest labourers. Were there more students of this branch of natural science amongst us, vexed questions of variation and distribution might be settled and our present knowledge of the molluscan fauna of Canada would certainly be very much increased.

F. R. LATCHFORD.
PASCAL POIRIER.

14th February, 1884.

MR. WHITEAVES enquired how many species of molluscs were known to exist in this locality.

MR. LATCHFORD replied that the Club lists enumerated over 100 species, and although it was probable that a critical revision might slightly reduce this number, he thought the reduction would in time be more than made up by species yet unnoticed here, but whose distribution to the south and east left little doubt of their occurrence in this vicinity.

MR. WHITEAVES stated that there were in North America two distinct types of bivalve; one eastern, ranging from the Atlantic to the Alleghanies, the other western, from the Mississippi to the Pacific, and that these two types overlapped to some extent. The introduction of the western species was probably due to canals and navigation through the great lakes. He thought that the Anodontas particularly had been unduly increased in number of species, and that the present tendency was to consider all North American forms as a single species analogous with *A. cygnea* of Europe.

MR. LATCHFORD said that while the number of Anodontas had undoubtedly been placed too high by the addition of synonyms, he was still far from thinking that our shells could by any possibility be reduced to one species; and further, that when the unvisited lakes and streams had been examined even a few more might be added to our list.

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REPORT OF THE ENTOMOLOGICAL BRANCH FOR THE SEASON OF 1883.

To the Council of the Ottawa Field-Naturalists' Club.

The depth of snow by which the ground was covered during the winter of 1882-3 was in a very high degree favourable to the preservation of insect life, by protecting hybernating larvæ and pupæ from sudden alternations of temperature, and from the attacks of birds, mice and other animals. In consequence the depredations of insects became noticeable almost simultaneously with the development of vegetation. Foliage, in many instances, was devoured in the bud, or immediately after expansion by the numerous larvæ which had safely hybernated. An even greater snowfall during the present winter will be conducive to an abundance of insects in the coming spring, and from having been protected for two successive winters, it is highly probable that many injurious species will prove decidedly troublesome during the coming season.

Although specimens of hybernating butterflies such as *V. antiopa* and *V. milberti* were seen as early as the 13th and 15th April, with some coleoptera, diptera and a few hymenoptera, the weather during that month was cold, and the snow disappeared slowly, there being a fall of about two inches as late as the 27th. It was only on the entrance of May that it became warm and favourable to the appearance of the main body of the insect army.

HYMENOPTERA. Observations were continued last summer on the family Uroceridæ, and one species not previously recorded as abundant or injurious was found in considerable numbers in and about the city. The species is known as the white-horned Xiphydria (*X. albicornis*, Harris), and the females may be observed from 15th June to end of July depositing their eggs in the bark of maple trees. A paper on this insect will be found in the Report of the Entomological Society of Ontario for 1883. The minute parasite *Pteromalus vanessæ* which was mentioned in last year's report as so frequently infesting the pupæ of *V. antiopa* was not nearly so abundant last summer, and a large proportion of chrysalids were free from them. Two broods of 19 and 11 were noticed, of which all the members passed successfully to the

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perfect butterfly. The chrysalids of *Pieris rapæ*, on the other hand, were very much infested by *Pteromalus puparum*, and the increase of this injurious butterfly was correspondingly checked. Sawfly larvæ, probably of *Nematus similaris*, were found feeding upon locust, but not in sufficient numbers to do much damage.

LEPIDOPTERA. Several good specimens belonging to this order were taken during the past season, and notes were made concerning the life histories of some of the better known species.

Among the Diurnals mention must be made of a handsome specimen of *Fenisica Tarquinius* taken by Mr. Hanham on 17th May, 1882, at Hull, and of a specimen of *Grapta J-album* taken by Mr. F. R. Latchford in the Beaver Meadow at Hull. Both of these are rare in this locality. Besides these not many rare butterflies have been added to our collections during the past season; the injurious insects, however, were, as usual, too well represented. The imported small white cabbage butterfly *Pieris rapæ* (notwithstanding the fact that hundreds of the larvæ died from a fungous disease when half grown), was very injurious in gardens, attacking the sweet mignonette, *Reseda odorata*, in preference to all other plants, not even excepting the cabbage itself. This latter plant, however, did not escape the visits of unwelcome guests; no sooner were the young plants put out in the spring than they were at once pounced upon by the flea-beetles, *Halticæ*, and the cabbage-fly, *Anthyomia brassicæ*, and in many places almost exterminated. The larvæ of the different cut-worms, *Agrotis*, also did their share, and later in the year the survivors were vigorously assaulted by unusual numbers of the beautiful black velvet and yellow striped caterpillars of *Mamestra picta*. This larva has usually been noticed here as feeding on sweet-peas and the feathery foliage of asparagus. In the latter instance, of course, it did very little harm.

The currant bushes seemed freer than usual last season from the ravages of the currant moths and saw-flies. These should never trouble the horticulturist, for with a little care and attention, such as two or three applications of powdered hellebore, they are easily mastered. The gooseberry fruit worm is much more difficult to combat and was very troublesome in the month of June. It was also plentiful on the wild gooseberries *Ribes oxycanthoides*, growing in Dow's swamp.

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Some fine specimens were secured of the different kinds of American silk worms. *Actias luna*, the swallow-tailed luna moth was particularly abundant both in the *larval* and *perfect* states, as also was *Telea Polyphemus*. *Platysamia Cecropia* and *Callosamia Promethea* occurred but not so commonly. The cocoons of the last two, however, are not uncommon on our city shade trees and in gardens: *P. Cecropia* chiefly on apple and maple trees, and *C. Promethea* almost entirely on lilac (*Syringa vulgaris*). All of these moths are preyed upon in their preparatory stages by birds who pierce the tough cocoons with their bills, and extract the juicy pupæ. They are also preyed upon in the larval state by parasitic Hymenoptera.

The larvæ of *Edema albifrons* were particularly abundant on maple trees in September and October. Several species of Lepidoptera have been reared from the larval stage during the past season; among the most interesting were *Darapsa versicolor*, from larvæ found on *Nesæa verticillata*. Other larvæ found on *Cephalanthus occidentalis*, but not brought to maturity were referred to this species. *Sphinx drupiferarum*, from plum trees; *Sphinx gordius*, from apple trees; *Sphinx kalmiæ*, from a pupa found beneath drift wood on Kettle Island by Mr. Harrington, on 19th May. This is particularly interesting as it must have been submerged for some weeks during the spring freshets.

Smerinthus excæcatus. A pair of these handsome moths was taken *in coitu* on the trunk of a white poplar in June. From these about 20 eggs were saved which began to hatch out on the 15th June. The first caterpillar was ready to pupate, and buried on 9th July. Last caterpillar buried on 19th July.

Callimorpha militaris. The larvæ of this moth were found very abundantly on wild gooseberry and maple in the month of June. Some larvæ were collected which pupated on 15th June, and produced the moths on 7th July. The moths were in great abundance, especially in Beechwood.

The Hickory Tussock moths, from larvæ collected at Hull on *Carya amora*.

A single specimen of the rare *Platycerura furcilla*, Pack. was bred from a larva taken on *Pinus strobus* at Stewarton in September, 1882. It spun up on 27th September, 1882, and emerged on 3rd June, 1883.

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The wingless female moths of the canker worm *Anisopteryx pometaria* were very plentiful during September and October, but no appreciable amount of damage has been observed in this locality from this cause.

On the whole, the season was a fairly good one for Lepidoptera.

DIPTERA. *Anthomyia radicum*, the Turnip-fly, was noticed as common, and as being destructive, while the Radish-fly *Anthomyia raphani*, Harris, (possibly identical with the foregoing) was particulary abundant, and in some localities almost entirely destroyed the crop of radishes. These are small greyish flies, somewhat resembling a diminutive house fly.

Some locust trees on Nepean street were badly infested by the larvæ of *Cecidomyia robiniæ* in July. The eggs are laid along the edges of the leaflets, and the irritation produced by the young larvæ causes the edge of the leaflet to curl over and swell up. Several larvæ were found on each leaflet, and the appearance of the graceful foliage was very sadly altered. The pupa state is also passed under the rolled portion of the leaf, and when the fly is ready to emerge the pupa works itself partially out at one end of the flap in order that the fly may make its appearance unrestrained.

COLEOPTERA. In this order, work has been so far advanced that Mr. Harrington has been able to prepare for publication a list of the beetles found in the vicinity. A visit was made to Ottawa in July by the late Dr. LeConte, for the express purpose of examining any local collections of Coleoptera, and of meeting those interested in entomology. Unfortunately, two of the leaders in this branch were absent, and were thus deprived of the pleasure of meeting that distinguished entomologist. Although Dr. LeConte's health had been failing for sometime, the tidings that he had died on 15th November came unexpectedly to most entomologists, all of whom felt that in his death entomology had sustained the loss of her most experienced and eminent student and teacher.

A great number of interesting species of beetles were taken during the year, including many not previously found, but mention can only be made here of a few species.

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Calosoma frigidum. A specimen of this beetle was taken on Kettle Island on 19th May. *C. calidum* is common here, but no other specimen of *frigidum* has come under our notice. Many other species of Carabidæ were taken on the same date. *Diplotaxis tristis.* On the occasion of the Club Excursion to King's Mountain on the 24th May, this beetle was very abundant under and on the pines near which the members lunched. *Hoplia trifasciata* was at the same time somewhat numerous on the flowers of *Viburnun lantinoides* and the catkins of willows. *Phymatodes thoracicus.* During the early part of June, Mr. Fletcher obtained a number of these interesting longicorns which had bred in an old wine cask then used by him as a water-barrel. *Toxotus vittiger.* This beetle was captured at Casselman at the Club Excursion of 23rd June. Among other interesting species taken on the same day were *Elaphrus cicatricosus, Languria inornata* (var. *gracilis*) *Aphodius hyperboreus, Leptura subhamata,* (on oak) *Disonycha carolin-iana,* (on *Rumex salicifolius*) *Silpha inæquale* and *Psephenus Lecontei,* all aditions to list. *Purpuricenus humeralis.* A fine male of this handsome beetle was taken near Rideau Hall on 27th June, and a female was found upon the sidewalk on Sparks Street, about a fortnight later. This species occurs in the middle and western States, and although recorded from Canada we have been unable to find where it was captured.

Tanysphyrus lemnæ, Fab. Immense numbers of this minute weevil were observed on 26th July upon the correspondingly minute water-plant *Lemna minor,* by which the surface of the brook flowing from Fairy Lake was entirely covered. On the same day the voracious blister-beetle *Macrobasis unicolor,* Kirby, was seen in destructive abundance on meadow-rue (*Thalictrum Cornuti*). *Stenotrachelus arctatus,* Say, was unusually numerous during October, and occurred until the middle of November. *Phyllobrotica decorata,* Say, was taken during July, at the Mer Bleue and along the Canal, feeding in large numbers upon *Scutellaria lateriflora.* Among injurious beetles which were destructive during the summer may be specially mentioned *Diabrotica vittata,* Fab., greatly infesting cucumbers, and *Crepidodera cucumeris,* Harris, and *Phyllotreta vittata,* Fab., which did great damage to all garden crucifers, such as cress, radishes, etc.

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Several bags of moss were collected in Dow's Swamp, Stewart's Bush, and near Hull, just before the snow fell, and a large number of beetles were obtained therefrom, including many (principally of Scydmænidæ, Pselaphidæ and Staphylinidæ) not previously found. The beetles so collected include representatives of over twenty families, and probably of nearly one hundred species, and are interesting as affording evidence of the hybernation of such a number of our species, including many which were not known to us as hybernating in the perfect state.

HEMIPTERA. So little work has been done in this order that we are only able to mention one or two species, which, by their abundance attracted attention during the summer. The destructive currant-aphis, *Aphis ribes*, Linn., infested both the red and white varieties, the leaves being all curled up and shrivelled. *Pœcilocapsus lineatus*, Fabr., was first noticeable from its ravages upon a large patch of burdocks in the city, the leaves of which were so badly attacked as to have the appearance of being scorched. Later in the season the bugs were found upon currant and mint; but these were by no means the only plants attacked by these very injurious insects. Many species of tree-hoppers and other plant bugs were remarked as being more than usually plentiful.

ORTHOPTERA. The only species which we have to mention in this order is *Œdipoda corallina*, Harris, which was seen in great abundance (it is usually rare here) in oat fields near Hull during the month of June, and which must have done considerable damage.

NEUROPTERA. We regret to have to state that nothing was done in this order.

ARACHNIDÆ. Since the inception of the Club a number of spiders and mites have been collected in this vicinity. A few of the former, mostly belonging to the genus Epeira (the species of which spin a wheel-like web) have been kindly determined by Mr. J. H. Emerton, of New Haven, Conn., and it will be interesting, at least, to record their occurrence.

Epeira trifolium, Henz., is a large and beautiful spider found in and about dwellings. Two specimens were collected by Mr. Ripley, formerly of this city.

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Epeira marmorea, Fabr., was found in large numbers hanging on a web between trees and blades of tall grass in the vicinity of Dow's Swamp, near the city.

Epeira patagiata appears to be rather common. A very dark variety is found occurring with the normal light-coloured variety.

Epeira scopetaria.

Epeira strix, Henz., is found along the banks of streams.

Epeira fasciata, Henz., (not the original *E. fasciata*, Latreille,) was found close to the ground in meadows and pasture fields.

Epeira displicata, Henz., is a small species found in meadows in the grass and on low bushes.

Dolomedes tenebrosus, Henz., is a large and beautiful spider, found in dry dark places, coming out of its hiding place at night in search of food. It does not spin a web, and carries its cocoon on its back.

Eylais extendens, Müller, is the round red water-mite which makes such a pretty object swimming round among the weeds in pools and sluggish streams.

Atax Bonzi, Claperède, was found under and between the gills of a number of Unio luteclus from the Rideau River.

Atax ypsilophorus, Bonz., was found in large numbers under the gills of *Anodonta fragilis* from Meech's Lake. This species has been already very well described and figured by Dana and Whelpley in Gilliman's Journal, vol. 30, under the name of *Hydrachna formosa* as occurring parasitic on some American unios.

W. HAGUE HARRINGTON,
JAMES FLETCHER.
J. B. TYRRELL.

28th February, 1884.

In answer to Mr. R. B. Whyte, it was explained that the larva which he had found so destructive to his gooseberries—living in the fruit—was that of *Anthomyia grossulariæ.*

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REPORT OF THE ORNITHOLOGICAL AND OÖLOGICAL BRANCH FOR THE SEASON OF 1883.

To the Council of the Ottawa Field-Naturalists' Club :

The leaders in ornithology and oölogy beg to report that good work was done during the past season in the branch under their charge.

No sub-excursions were organized, other than those participated in by all the members of the Club, as it was found that, although productive of a large increase of work in other branches, they were, except in special cases, unsuitable to ornithology.

The colony of great blue herons (*Ardea herodias*, L.) mentioned in last year's report was visited on 18th May by a gentleman from Lennoxville, P.Q., who states that he was obliged to wade to the nests through water from three to four feet deep. He climbed four trees, and obtained, in all, thirty-eight eggs, all of which, however, were hard set. He says, moreover, that every nest contained from five to six eggs, whereas, when the heronry was visited in July, 1882, not more than three young birds were found in any one nest. Whether these numbers are usual, and if so, what causes the discrepancy between the number of eggs laid and the number of those which mature are questions well worthy of investigation next season.

During the past season the following species have been added to the "List of Birds found in the Vicinity of Ottawa," published in Nos. 3 and 4 of the "Transactions." The numbers refer to Coues' "Check List of North American Birds," 1882 edition.

13. *Turdus ustulatus swainsoni* (Cab.) Coues' Olive-backed Thrush. A fine specimen of this thrush was shot on the 14th April last, on the banks of the Rideau River, by Mr. Edward White. Later, on the 19th May, a pair was observed on Kettle Island by Mr. W. L. Scott, and the male bird shot. It is quite probable that they breed here, as the last mentioned locality is frequently the breeding place of numbers of Wilson's thrushes (*Turdus fuscescens*, Steph.).

81. *Cistothorus stellaris* (Licht.) Cab. Short-billed Marsh Wren. A female of this bird was shot in a beaver meadow not far from the

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city on 2nd June by Mr. Geo. R. White. Mr. Scott found the same species very abundant during the month of August in the marshes along the Rideau, about twenty miles from the city.

126. *Dendroeca tigrina* (Gm.) Bd. Cape May Warbler. Mr. E. White succeeded in securing a pair of these rare warblers near the Rideau River on the 24th May. Dr. Coues says that they are "not a common bird with us," and Audubon states that they are exceedingly rare. According to the list of Messrs. Morden and Saunders, only one specimen is recorded from Western Ontario. Mr. McIllwraith, however, in his list of the birds of Hamilton, considers them as only "rather rare." They are not mentioned in Mr. Chamberlain's list of the birds of St. John, but are stated, in an appendix, to occur in other parts of New Brunswick.

173. *Vireo philadelphicus*, Cass. Brotherly-love Vireo. A single specimen was shot on 2nd June by Mr. E. White.

176. *Vireo flavifrons*, V. Yellow-throated Vireo. A male bird shot towards the middle of June.

177. *Vireo solitarius*, V. Solitary, or Blue-headed Vireo. A male of this bird was shot on 2nd October by Mr. E. White.

227. *Passerculus sandvicensis savana* (Wils.) Ridg. Common Savanna Sparrow. Specimens of this diminutive sparrow were obtained by Prof. Macoun in the month of May, in the vicinity of the St. Louis Dam; and Mr. Geo. R. White noticed them about the Rifle Range, where they were probably breeding, during the whole of the summer.

282. *Passerella iliaca* (Merr.) Sw. Fox Sparrow. Three specimens of this handsome sparrow were shot, one in April, one towards the beginning of June, and one on 8th November.

380. *Contopus borealis* (Sw.) Bd. Olive-sided Flycatcher. A pair was shot within a short distance of the city on 24th May.

385. *Empidonax trailli* (Aud.) Bd. Traill's Flycatcher. Two specimens of this flycatcher were obtained, one on 13th May by Prof. Macoun and a second on 24th May by Mr. E. White.

444. *Picoïdes americanus*, Brehm. Banded-backed Three-toed Woodpecker. A fine female of this bird was shot by Mr. E. White on 5th November.

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473. *Asio accipitrinus* (Pall.) Newt. Short-eared Owl. On Oct. 6th Mr. Geo. R. White shot a pair of these owls not far from the city, and on 28th October another individual was seen by Mr. Scott.

505. *Falco columbarius*, L. Pigeon Hawk. A fine male was shot on 7th April while in pursuit of some tame pigeons.

524. *Buteo pennsylvanicus* (Wils.) Bp. Broad-winged Buzzard Hawk. Prof. Macoun shot a specimen of this bird on 15th May; a second specimen was shot on 24th May.

525. *Archibuteo lagopus sancti-johannis* (Gm.) Ridg. American Rough-legged Buzzard. On the 8th November last a male of this fine hawk was shot not far from the city by Mr. Geo. R. White.

532. *Aquila chrysaëtus*, (L.) Cuv. Golden Eagle. A female of this species was shot on 30th Oct. by Mr. J. Saxon Castleman on the banks of the River Castor, about two miles and a half above Casselman Station, and forty miles from the city. Another was seen near the same place a short time afterwards. Mr. Castleman says he recollects having seen two or three other specimens which were taken in his section in the past; and there are also other recorded instances of its occurrence in this locality.

617. *Actodromas bonapartii* (Scl.) Coues. White-rumped Sandpiper. One specimen shot. It was found in company with a number of other sandpipers, principally Least (*Actodromas minutilla* [V.] Coues), and Pectoral (*Actodromas maculata* [V.] Coues).

Most of the species enumerated above were kindly checked by Dr. Coues, of Washington, D.C.

Besides the above, additional specimens of the following species which appeared in last year's "List of Additions" were taken during the past season:

Myiodioctes pusillus (Wils.) Bp. Green Black-capped Fly-catching Warbler. This species appeared to be quite common, for some days, towards the middle of last May.

Chrysomitris pinus (Bartr.) Bp. Pine Linnet. A flock of these birds was seen on 30th October, and another on 11th November; but, so far, they do not appear to be nearly as common as they were last year.

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Spatula clypeata (L.) Boie. Shoveller Duck. Two females of this duck were observed on the Ottawa, some distance below the city, last October.

On page 34 of *Transactions* No. 3, No. 609 should have been omitted.

The following is a list of birds, giving the dates on which they were first noticed, in the vicinity of Ottawa, last spring (1883). It is hardly necessary to remark that these dates are merely the dates on which the birds were *first noticed*, and that many of them may have really arrived much earlier :

Feb'ry 20—*Eremophila alpestris* (L.) Boie., Shore Lark.
March 1—*Corvus frugivorus* Bartr., Crow.
" 10—*Astur atricapillus* (Wils.) Bp., Goshawk.
April 1—*Turdus migratorius* L., Robin.
" 6—*Sialia sialis* (L.) Hald., Blue-bird.
" 7—*Melospiza fasciata* (Gm.) Scott. Song Sparrow.
" 9—*Iridoprocne bicolor* (V.) Coues., White-bellied Swallow.
" 9—*Ardea herodias* L., Great Blue Heron.
" 9—*Quiscalus purpureus æneus* Ridg., Bronzed Grackle.
" 10—*Junco hiemalis* (L.) Scl., Common Snowbird.
" 10—*Contopus virens* (L.) Cab., Wood Peewee.
" 11—*Regulus satrapa* Licht., Golden-crested Wren.
" 11—*Sphyropicus varius* (L.) Bd., Yellow-bellied Woodpecker.
" 13—*Sturnella magna* (L.) Sw., Meadow Lark.
" 13—*Sayiornis fusca* (Gm.) Bd., Pewit Flycatcher.
" 14—*Mergus merganser* L., Goosander.
" 14—*Poœcetes gramineus* (Gm.) Bd., Bay-Winged Bunting.
" 14—*Colaptes auratus* (L.) Sw., Golden-winged Woodpecker.
" 14—*Astragalinus tristis* (L.) Cab., Goldfinch.
" 14—*Agelœus phœniceus* (L.) V., Red-winged Blackbird.
" 14—*Turdus unalascœ nanus* (Aud.) Coues., Hermit Thrush.
" 14—*Turdus fuscescens* Steph., Wilson's Thrush.
" 14—*Progne subis* (L.) Bd., Purple Martin.
" 14—*Ceryle alcyon* (L.) Boie., Kingfisher.
" 14—*Certhia familiaris* L., Brown Creeper.
" 15—*Spizella domestica* (Bartr.) Coues., Chipping sparrow.
" 15—*Zonotrichia albicollis* (Gm.) Bp., White-throated Sparrow.
" 15—*Anas obscura* Gm., Black Duck.
" 15—*Molothrus ater* (Bodd.), Gray Cowbird.
" 15—*Zonotrichia leucophrys* (Forst.) Sw., White-crowned Sparrow.
" 17—*Mergus cucullatus* L., Hooded Merganser.
" 18—*Carpodacus purpureus* (Gm.) Gr., Purple Finch.
" 21—*Hirundo erythrogastra horreorum* (Bart.) Coues., Barn Swallow.

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April 21—*Gallinago wilsoni* (Temm.) Bp., Wilson's Snipe.
" 26—*Spizella monticola* (Gm.) Bd., Tree Sparrow.
" 28—*Pandion haliaëtus* (L.) Sav., Fish Hawk.
May 2—*Dendrœca coronata* (L.) Ga., Yellow-rumped Warbler.
" 2—*Chaetura pelasgica* (L.) Steph., Chimney Swift.
" 2—*Aïx sponsa* (L.) Boie., Wood Duck.
" 2—*Circus cyaneus hudsonius* (L.) Coues., Marsh Hawk.
" 3—*Anorthura troglodytes hiemalis* (Wils.) Coues., Winter Wren.
" 3—*Troglodytes domesticus* (Bartr.) Coues., House Wren.
" 3—*Accipiter fuscus* (Gm.) Bp., Sharp-shinned Hawk.
" 5—*Passerculus sandvicensis savana* (Wils.) Ridg., Savanna Sparrow.
" 5—*Ægialites vociferus* (L.) Cass., Killdeer Plover.
" 5—*Tringoïdes macularius* (L.) Gr., Spotted Sandpiper.
" 10—*Mniotilta varia* (L.) V., Black and White Creeper.
" 10—*Parula americana* (L.) Bp., Blue Yellow-backed Warbler.
" 10—*Helminthophila ruficapilla* (Wils.) Bp., Nashville Warbler.
" 10—*Dendrœca aestiva* (Gm.) Bd., Summer Yellowbird.
" 10—*Siurus auricapillus* (L.) Sw., Golden crowned Thrush.
" 10—*Pyranga rubra* (L.) V., Scarlet Tanager.
" 10—*Zamelodia ludoviciana* (L.) Coues., Rose-breasted Grosbeak.
" 10—*Melospiza palustris* (Bartr.) Bd., Swamp Sparrow.
" 10—*Icterus galbula* (L.) Coues., Baltimore Oriole.
" 10—*Falco sparverius* L., Sparrow Hawk.
" 11—*Turdus mustelinus* Gm., Wood Thrush.
" 12—*Tyrannus carolinensis* (L.) Bd., Kingbird.
" 13—*Myiodioctes pusillus* (Wils.) Bp., Green Black-capped Fly-catching Warbler.
" 13—*Anthus ludovicianus* (Gm.) Licht., Titlark.
" 13—*Rhyacophilus solitarus* (Wils.) Bp., Solitary Sandpiper.
" 14—*Mimus carolinensis* (L.) Gv., Cat-bird.
" 14—*Chordediles propetus* (V.) Bd., Night Hawk.
" 14—*Totanus melanoleucus* (Gm.) V., Greater Yellow-legs.
" 15—*Setophaga ruticilla* (L.) Sw., Redstart.
" 17—*Helminthophila perigrina* (Wils.) Cab., Tennessee Warbler.
" 17—*Ampelis cedrorum* (V.) Bd., Cherry Bird.
" 19—*Myiodioctes canadensis* (L.) Aud., Canadian Fly-catching Warbler.
" 19—*Myiarchus crinitus* (L.) Cab., Great-crested Fly-catcher.
" 19—*Empidonax minimus* Bd., Least Fly-catcher.
" 19—*Melanerpes erythrocephalus* (L.) Sw., Red-headed Woodpecker.
" 24—*Dendrœca castanea* (Wils.) Bd., Bay-breasted Warbler.
" 24—*Actodromas minutilla* (V.) Coues., Least Sandpiper.
June 2—*Vireo olivaceus* (L.) V., Red-eyed Vireo.

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Last spring, most of the winter birds were very late in going north. Red Cross-bills(*Loxia curvirostra americana*, [Wils.] Coues) and Pine Linnets (*Chrysomitris pinns*, [Bartr.] Bp.) were seen as late as 10th May, and the Pine Grosbeaks (*Pinicola enucleator* [L.] V.,) which had been particularly abundant all season, were not all gone before 21st April, up to which date also the lesser Red-polls (*Ægiothus linaria* [L.] Cab.) were still with us.

Several pairs of the last mentioned species, indeed, must have remained a good part of the summer, for Prof. Macoun noticed them up to the 6th of June, among some cedar bushes at the west end of Maria street, where they appeared to be breeding. But, as Prof. Macoun left town on the date mentioned, and remained away the greater part of the summer, their further movements are unknown.

This fall, too, the winter birds have appeared very early. Five Bohemian Waxwings (*Ampelis garrulus*, L.) were seen feeding on the seeds of a Black Birch (*Betula lenta*) on 11th November, and two others were seen a few days afterwards. The Pine Grosbeaks and Red-polls were still earlier, the former arriving on 1st November and the latter on 30th October. Some of our summer birds have, on the other hand, far outstayed their usual limits; for a Robin (*Turdus migratorius*, L.) was shot on 15th November, and a male Goldfinch (*Astragalinus tristis* [L.] Cab.) on the 25th of the same month.

Tree Sparrows (*Spizella monticola* [Gau.] Bd.) were unusually abundant here this fall, while on their way south, i. e. from 24th to 30th October, Yellow-rumped Warblers (*Dendrœca coronata* [L.] Gr.) were seen on 6th October. The latter species was particularly common last spring, from the beginning till towards the end of May. The Nashville Warbler (*Helminthophila ruficapilla* [Wils.] Bd.), formerly considered very rare in this locality, was also quite common towards the middle of last May. Two additional specimens of the Hudsonian Chickadee (*Parus hudsonicus* Forst.) have been noted this fall, the one by Mr. Scott, the other by Mr. George R. White, bringing the total number recorded from this locality up to six.

The leaders beg to call attention to the fact that every member of the Club, whether directly interested in the study of Ornithology or not, may render very material assistance to the work of the branch by

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noting down the earliest date on which any bird is seen in the spring, and transmitting these notes to the leaders at the close of the season. Notes of the latest dates, on which the birds are seen, in the autumn, are also of great value.

The leaders cannot close this report without calling attention to a great event in the history of Ornithology, which took place during the past season. Last September, a number of the ablest Ornithologists on the continent held a meeting in New York City, and founded the "American Ornithologists' Union." The formation of such a society was the one thing necessary to ensure the rapid and systematic development of American Ornithology. Should any of the members of the Ottawa Field-Naturalists' Club be desirous of bringing any notes, or other communications, before the notice of the Union, they may do so through the medium of either Professor Macoun or Mr. W. L. Scott, both of those gentlemen having been elected associate members of that body.

JOHN MACOUN,
GEO. R. WHITE,
W. L. SCOTT,
Leaders.

20th December, 1883.

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REPORT OF THE ZOÖLOGICAL BRANCH.

To the Council of the Ottawa Field-Naturalists' Club :

In making a report on what was done last year in this branch, the difficult question presents itself, what is left to zoölogy outside of the branches of it which have already reported on their sections of animal life, viz., the ornithological, conchological and entomological, seeing that the field of enquiry and discovery has been well worked by the leaders of those branches. As, however, zoölogy covers all animal life, the leaders of this branch consider that it embraces any fact in the animal kingdom worthy of notice not as yet reported during the past year. No regular sub-excursions of the Club in this branch were held, but a number of interesting facts were noted by various members, and the following brief observations are now submitted as likely to prove of local interest.

Mr. Scott, who partially took up the study of the *randiæ* or frogs, mentions four species as coming under his notice, viz., the Leopard Frog (*R. halecina*, Kalm), both green and brown skin, with large distinct spots (the green being the true edible frog), and the Bull-frog (*R. catesbiana*), both abundant; the Pickerel Frog? (*R. palustris*, LeConte), which he found only in Patterson's Creek, and the Wood Frog (*R. temporaria*, LeConte,) var. *sylvatica*, tolerably common. The last is a small species, with a heavy dark brown line on each side of the head, and varying considerably in colour. Mr. Scott has experimented with a pair taken by him on the 9th November, since which date he has kept them in his room in a vessel with about half an inch of water, renewed daily. Although not becoming torpid, owing probably to the artificial warmth, yet they refused food of all kinds absolutely, and this circumstance evinces the fact of the *ranidæ* being able to sustain life for long periods without food.

The duration of the hibernation of frogs depends materially on climatic conditions of the seasons. A Leopard frog is reported to us as found above ground on the 7th November, and a mass of frog spawn was noticed on the 20th April, showing that the depositors of it had already been at work. The 23rd or 24th April is usually the date on which frogs are first heard in this vicinity, but local causes may so

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influence certain ponds as to arouse the hibernating animals earlier than in others, such, for instance, as a large inflow of warm surface water into a small pond, or the effect produced by the reflection of the sun's rays from rocks surrounding it.

Three species at least of tree toads have been noticed in this vicinity, but only one actually placed, the common Tree Toad (*Hyla versicolor*), of which several young specimens were seen on small pines on 17th May. A few full grown specimens were met with during the summer. The study of the tree toad is desirable, as there is no record of the varieties in this vicinity. Mr. Harrington reports having taken a smaller yellowish tree toad whilst beating shrubbery for insects. It is apparently not so abundant as *Hyla versicolor*, and he thinks it is *H. Pickeringii*, Pickering's tree toad of Polbbook. It would be desirable to have a good series of frogs and toads, snakes and lizards collected, so that the varieties and species might be separated.

The study of snakes and the dates of their first appearance and hibernation in this district has not yet been specially taken up, as far as we are aware. Both Mr. W. L. Scott and Mr. Harrington are working with a view to presenting notes and lists to the Society at some future day on this subject. Mr. Harrington, on 6th May, observed quite a gathering of snakes in Stewart's bush amongst some loose stones, beneath which they had probably hibernated, fully two dozen being seen within a radius of a few yards. Amongst them he noticed three ring-necked snakes (*Diadophis punctatus*), one young and the others 16 to 19 inches long respectively; several large red-bellied snakes (*Storeria occipitomaculata*) about ten inches long, and a number of young snakes one-third that length; also several garter snakes (*Eutænia sirtalis*) about 15 inches in length.

On May 8th, Mr. Harrington found a specimen of the viscid salamander (*Plethodon glutinosus*, Baird) under a rotten log, and on 19th May five specimens of a pretty blue spotted salamander about three inches long under pieces of board and rubbish on the lower end of Kettle Island. This is apparently Jefferson's salamander (*Amblystoma jeffersonianum*, Baird). On 24th May, a number of small semiaquatic salamanders were observed under stones at the edge of the rapids at Hogsback, probably the yellow desmognath (*Desmognathus ocrophæa*,

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Cope). Careful research may reward the student in this branch, of which very little is known in this district.

Mention was made in a paper on the fish of the Ottawa district, read before your Society last winter, of a red-bellied minnow, supposed to be a species peculiar to this district, but of the existence of which as a separate species there is much doubt. Nothing has been ascertained further during the past year, but information is desired respecting it. The sheepshead (*Haploidonotus grunniens*, Jordan), which, years ago, was abundant, but which of late has been a rarity in the Ottawa River, is again making its appearance on our markets, and it would be interesting to ascertain whether its reappearance is due to fish protection and the absence of universal netting, or to local causes affecting the water, or to the reappearance of certain food it preys upon. Mr. Harrington noted a large number of dead fish—pike, bass, suckers, perch, etc.—in St. Louis Dam on 28th April. This circumstance has been frequently noticed in that locality in spring, and has been attributed to impurities draining into that body of water during winter from factories and tanyards in its vicinity. Another probable cause of this recurring mortality might be traced to the solid coating of ice over the shallows which are left after the water has been let out of the canal at the approach of winter, and which prevents the fish which remain there from obtaining air. It is a well known fact that, in a pond completely frozen over, unless an opening exists where the fish can approach the surface for air, the majority of them will perish during winter. As the water of the canal is not let out until ice of a considerable thickness has formed, the superincumbent weight settling down with the outflow of the water probably prevents the passage of the fish from many of the pools or shallows, and even presses upon them, or they may congregate in the slightly deeper parts of the dam which later in the winter freeze to the bottom.

A close study of the lake trout of this district is desirable, as it is a disputed point amongst naturalists whether there are really more than one species, and if the so-called different species are not only varieties, influenced by locality, water and food.

Two species of field mice were noticed, the white-footed or deer-mouse (*Hesperomys leucopus*), and the meadow mouse (*Arvicola riparia*),

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which is troublesome both in the cellar and garden; in the latter especially, being very destructive during early spring, preying on the tender shoots of plants. These are the mice so detrimental to young orchards in winter, when they bark the young trees beneath the snow to such an extent as to destroy them as completely as if girdled. Last summer a pair of jumping mice (*Zapus hudsonius*, Zimmerman) were found at Prescott, and although that place is not in the Ottawa district, yet it is so near as to induce the idea that it is not improbable they may be found in this vicinity. We have heard of a pair being taken on the Aylmer Road a few years ago, but nothing accurate is known of the capture.

In conclusion, we appeal to the members of the Club to note down any interesting fact that comes before them during the next season of outdoor observations. Much information full of valuable import might thus be imparted to the Club as a body which may appear perhaps trivial to the individual. If members also would make lists of the objects they notice for the purpose of comparison and record the dates of first and last appearance of the rare species, these would be very useful. In following out one branch of natural history any interesting feature of another branch should never be overlooked, as every contributor to science of local interest becomes to a certain extent a public benefactor.

H. B. SMALL.
W. P. LETT.
Leaders.

31st January, 1884.

Mr. R. B. Whyte said the refuse from tan vats was quite sufficient to kill fish, and there was a tannery emptying into St. Louis Dam. He stated that in former years a creek ran down Mosgrove street, on which a tannery was situated, and that every time the vats were emptied numbers of dead fish were seen in the creek.

Mr. Fletcher said that the kangaroo mouse had been found near Aylmer, and that he had, in the month of January, seen frogs moving about in the canal near the Bank Street Bridge, in a pool possibly kept open by a warm spring.

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Mr. Scott said the finding of the kangaroo mouse was important, as it belonged to the Alleghany fauna. He enquired whether pure spirits should be used for preserving reptiles.

Mr. Small said that care should be taken that the spirits were not too strong, as, if they were, the colour and tissue were both apt to be damaged and perhaps destroyed. He had found from experience that the ordinary druggists' alcohol, 15 above proof, diluted with one-third its quantity of water, was the proper strength. It would also be found very convenient for the collector to keep a common wide-mouthed jar in which to place his specimens when collected, to lie in the spirits till required. A few days after being placed in the liquid they should be taken out and pricked in several places with a sharp pin or needle. This would allow the gas to escape and prevent any discolouration. They could always, if kept under the liquid, be placed in any shape required, as they remained perfectly pliant.

Prof. Macoun had lost some specimens of small fishes by using too strong alcohol.

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OTTAWA FIELD-NATURALISTS' CLUB

Transactions No. 6

VOLUME II. No. II.

OTTAWA, CANADA:
Citizen Printing and Publishing Company, Metcalfe St.

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OTTAWA

FIELD-NATURALISTS' CLUB.

TRANSACTIONS NO. 6.

VOL. II. NO. II.

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ANNUAL REPORT OF THE COUNCIL.

To the Members of the Ottawa Field-Naturalists' Club:

The Council has much pleasure in reporting that the progress of the Club during the past year has been very encouraging. The membership has largely increased, being now 168, the number of new members elected having been 50. Two corresponding members have also been elected, viz.: Mr. J. B. Smith, of Brooklyn, N.Y., a prominent entomologist, and Dr. C. Hart Merriam, the secretary of the American Ornithologists' Union.

The Club excursions were four in number. The first was held on 22nd May, and to it were invited the members of the Royal Society of Canada, then in session in Ottawa, and delegates to that society, with their families. Kingsmere was visited and there were present over 100 persons, of whom 36 were guests of the Club. The second excursion was to Buckingham on 12th June, while the third was held on 24th July, when, through the kind liberality of Capt. Goulet, the Club was enabled to visit the Chat Falls in the Steamer *Chaudiere.* As a slight recognition of Capt. Goulet's generosity toward the Club, two volumes on natural history have been purchased and bound for presentation to him. They are "La Terre et les Mers," by Figuier, and Wood's "Natural History." The fourth excursion was to Casselman on 21st Aug., when the members were kindly received by Mr. and Mrs. Castleman, who have since removed to California. All these excursions were well attended, and were successful in every respect; the first one being the largest and most important yet held.

Sub-excursions were also held on Saturday afternoons during the season, and a number of interesting localities were thus visited.

At the Dominion Exhibition held here in September the Club was represented by collections in various branches, and the exhibit attracted much attention. A silver medal and diploma were specially awarded the Club for the exhibit as a whole, while the following members received individual awards:—Dr. Small, a silver medal for collection of reptiles; Mr. Henry M. Ami, first prize and diploma for geological specimens; Mr. H. P. Brumell, several prizes for minerals;

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Mr. R. B. Whyte, first prize for botanical collection; Mr. Fletcher, two first prizes and extra prize for insects; Mrs. Chamberlin, special prize for paintings of fungi; Mr. F. R. Latchford, special prize for collection of land and fresh water shells; and Mr. W. L. Scott, special prize for collection of eggs.

The application mentioned in last year's report, as having been made to the Ontario Legislature for a grant, was unsuccessful, and further efforts during the present year have also resulted in failure.

A large number of very valuable publications have been received in exchange for the Transactions of the Club, or as donations from persons interested in its work, and it has been necessary to purchase book shelves for their reception and to have a number of volumes bound.

Transactions No. 5, Vol. II, No. 1, were published in due time, and contained 152 pages. They have been very favorably noticed by various scientific journals, and have been largely asked for in exchange for other publications.

The winter course of meetings comprised six Soirées, which were well attended, and at which valuable papers and reports were read, which will appear in the next number of the Transactions.

In addition, afternoon lectures were given in Botany, Mineralogy and Ornithology by Prof. Macoun, Mr. Willimott and Mr. W. L. Scott, respectively.

The Botanical Class conducted during the previous winter by Mr. Fletcher was continued by him until the end of May.

At a special general meeting of the Club held on the 28th March the Rules formerly in force were somewhat modified and enlarged in order to provide a Constitution in accordance with the terms upon which incorporation was obtained. A copy of this Constitution was sent to each member, and it was published in the Transactions.

The Council, in performance of their duties, met twenty-three times, with an average two-thirds attendance, while a large proportion of the work was performed by the Standing Committees on Excursions, Soirées and Publishing.

Signed on behalf of the Council,

W. H. HARRINGTON,

Secretary.

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TREASURER'S BALANCE SHEET.

Dr. *The Treasurer in account with the Ottawa Field-Naturalist's Club*, 1884-85. *Cr.*

RECEIPTS.		EXPENDITURE.	
To balance from 1883-84.....	$ 12 32	By excursion expenses.....	$ 92 61
Membership fees.....	184 00	Soirée do	5 50
Excursion receipts.....	96 45	Cost of Transactions No, 5..	162 50
Soirée do	2 50	Library expenses.....	13 07
Sales of Tansactions.....	30 75	Printing, miscellaneous....	17 45
		Postage, stationery, etc.....	13 42
		Balance on hand.....	21 47
	$326 02		$326 02

WM. P. ANDERSON,
Treasurer.

20th March, 1885.

ADDITIONS TO LIBRARY.

Among the more valuable exchanges and donations received during the year by the librarian (space cannot be afforded for his complete list) were the following :—

Geological and Natural History Survey of Canada :—"List of Publications," "Reports of Progress." 1870-1882 and Maps, "Palæozoic Fossils," "Mesozoic Fossils," "Fossil Plants," "Figures and Descriptions of Canadian Organic Remains," Decades I-IV, "Catalogue of Canadian Plants," Part I., etc., etc.

Linnæan Society :—"Transactions." Vol. I, etc.

Historical and Scientific Society, Winnipeg :—"Transactions." 12 Nos., etc.

U. S. Geological Survey :—"Mineral Resources of the U. S.," etc.

Brooklyn Entomological Society :—"Bulletin." Vols. I-VII.

Dr. C. Hart Merriam :—"Mammals of the Adirondacks," etc., etc.

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Cambridge Entomological Club:—"Psyche." Vols. I, II, Vol. VI, Nos. 117, 129.

Royal Society of Canada:—"Transactions." Vol. I.

Torrey Botanical Club:—"Bulletin." Vol. XI, Vol. XII, Nos. 1, 3.

American Association for the Advancement of Science:—"Proceedings of the Minneapolis Meeting, 1883."

Prof. Edward S. Morse:—A very valuable collection of Papers and Addresses on Ornithology, Conchology, Ethnology, etc., etc.

Dr. George Vasey:—"Agricultural Grasses of the U. S.

American Ornithologists' Union:—"The Auk." Vol. 1.

H. B. Small:—"Reports of Dept. Agriculture, Canada," 1870-1883.

Prof. C. V. Riley:—Entomological "Bulletins" and "Reports," etc.

Entomological Society of Ontario:—"Canadian Entomologist," Vols. I-XVI., "Annual Reports," 3-14, and Index 1-13.

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REPORT TO THE ROYAL SOCIETY OF CANADA.

(Read at the Third General Meeting, May, 1884.)

During the year that has elapsed since my last report, the Ottawa Field Naturalists' Club has pursued its special work of developing the Natural History of this neighborhood, with all its former vigor and activity, and its prospects have never been more promising than at the present time. It has added forty new names to its roll; it has become an incorporated society in accordance with the Ontario Statutes, and marked success has attended its efforts in every branch of Natural History. In the summer months much zeal was displayed in pursuing the field work, and the efforts of the Council have been specially directed to rendering this work as systematic as possible. Under the direction of the leaders, the various branches,—representing Geology, Mineralogy, Botany, Entomology, Conchology and Ornithology,—made numerous afternoon excursions, some of them being held fortnightly throughout the season. These were well attended by the working members, and those desirous of becoming acquainted with the study of the branch; and in many instances they assumed the character of classes for the instruction of beginners. The regular excursions were held monthly, the attendance varying from twenty-five to sixty. The first excursion of this season has been arranged for Thursday next, that the Club may have the honour of entertaining the Fellows of this society on an outing among the ever attractive Laurentides, and to allow those who are interested in Natural History an opportunity of studying this neighbourhood.

Our soirées or winter meetings were seven in number, at which reports of the work done in the sections during the summer were presented, and papers read on subjects of local interest. The following is the programme :—

Dec. 6th, 1883.—Inaugural Address, by the President.

" 20th, 1883.—Notes on the "Flora Ottawænsis," with special reference to the introduced plants, by J. Fletcher.

Report of the Ornithological Section.

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Jan. 7th, 1884.—The Sand-plains and Changes of Water-level of the Upper Ottawa, by E. Odlum.

Report of the Geological Section.

Notes on, and a list of, the Cambro-Silurian Fossils of the vicinity of Ottawa, by H. M. Ami, B.A.

Jan. 31st, 1884.—Edible and Poisonous Fungi, by J. Macoun, M.A., F.L.S., F.R.S.C.

Report of the Botanical Section.

Feb. 14th, 1884.—Ottawa Coleoptera, by W. Hague Harrington.

Revision of the Suctoria, by J. B. Tyrrell, B.A., F.G.S.

" 28th, 1884.—The occurrence of Phosphate Deposits, by G. M. Dawson, D.S., Assoc. R.S.M., F.G.S., F.R.S.C.

Note on a new species of Archæocrinus, by W. R. Billings.

Report of the Entomological Section.

March 13th, 1884.—The Deer of the Ottawa Valley, by W. P. Lett.

Report of the General Zoology Section.

Classes of instruction were continued throughout the winter months, that in Botany being especially successful under the direction of Mr. Fletcher. The attendance was large, and the examination held at the close showed that the course had been earnestly followed. No. 4 of our Transactions has been issued, containing 84 pages and a plate. It embraces the work of the winter of 1882-3, (a copy of which is presented herewith). Our Library is now assuming considerable proportions, being entirely formed of publications received in exchange for our Transactions. As they are all devoted to Natural History and kindred subjects, and represent the work of Naturalists throughout the country, they form a most valuable collection of original papers, such as are not to be found in the ordinary scientific works.

The officers for this year, elected at the annual meeting in March, are :—

Patron—His Excellency the Governor General.

President—H. Beaumont Small, M.D.

Vice-Presidents—1st, James Fletcher; 2nd, R. B. Whyte.

Secretary—W. H. Harrington.

Treasurer—W. P. Anderson.

Librarian—W. L. Scott.

Committee—Prof. J. Macoun, H. M. Ami, F. R. Latchford.

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As an evidence of the work we have accomplished, the lists published in our Transactions are worthy of notice. In the field of Botany 920 plants have been collected ; of shells we have found 208 species ; of birds 198 ; of fishes 48 ; and of insects 1004. This last collection, presented by Mr. Harrington during the past winter, is one of special merit. It is arranged and named after the revised classification of Drs. LeConte and Horn, and is probably the first so adopted in this country. As all the collections have been made within a few miles of this city, I think we can reasonably claim to have one of the most thoroughly worked districts of Canada. This local study of Natural History is one we would earnestly ask the Royal Society to encourage. Were local societies, instead of wandering aimlessly among the paths of natural science, to devote themselves to this work, and report it to the meetings of your Society, there would soon be accumulated a fund of information more perfect and complete than by any other method.

May, 28th, 1884.

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PRESIDENT'S INAUGURAL ADDRESS.

H. BEAUMONT SMALL, M.D.

(DELIVERED 4TH DEC., 1884.)

Members of the Ottawa Field-Naturalists' Club, Ladies and Gentlemen:

It is a very great pleasure to me to welcome you here this evening, to inaugurate our sixth series of winter meetings, more particularly as the prospects of the Club are in no way dimmed, and the continued success that attends our efforts is a subject for mutual congratulation. It has been the fate of many Natural History associations to have commenced with equally bright prospects, to have flourished for a year or two and then to have languished and died from a lack of the energy that brought them into existence. With our Club it has been different, each year brings increased strength and each season's work attracts and retains the interest of its members. The reason for this is obvious, for we have a special object in view and a congenial work to perform, and as the knowledge of our local resources increases the desire to augment that information becomes greater.

Since my last address our society has become incorporated in accordance with the Statutes of Ontario. In taking such a step the Council has recognized the prospects of our permanent existence and made the foundation more secure, but the main object in thus becoming a legitimate provincial organization was to pave the way for procuring a Government grant. In this, however, we have not been successful. Our application was apparently received with favor, the Commissioner of Education was visited personally and acknowledged the worthiness of our claim, but we have not received any substantial response. Further attempts will be made this winter, let us hope with better results. The grant of even a small sum would prove of inestimable value; at present all our revenue has to be carefully expended to provide for the necessary current expenses and many much needed improvements postponed for want of funds. Had we the required means our usefulness would be much increased; many schemes might be adopted to stimulate members to greater activity, original research

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could be more forcibly promoted, and public benefit achieved by circulating in the surrounding country much useful information.

That members have been doing valuable work has been recognized, and a compliment has been paid to the Club by the selection of one of our number to fill the position of Honorary Entomologist to the Department of Agriculture. We all congratulate Mr. Fletcher on the position he has attained, and I am sure he will receive assistance from every member of the Club in carrying on such observations as may be required of him.

The summer which has passed by has been one of more than ordinary activity to those inclined towards science. The Royal Society met in this city for the third time, affording us another opportunity to attend its meetings and listen to its papers and discussions. As no effort was made by our citizens to recognize the presence of the society here, your Council extended to them an invitation to attend our first excursion, arranged specially for their convenience to the Chelsea mountains. The spot selected was the ever-attractive Kingsmere, the suitableness of which was greatly enhanced by the kindness of Mr. and Mrs. Bourinot, who placed their house and grounds at our disposal and assisted in every way to arrange for the comfort of our visitors.

The day was all that could be desired, our members supported the Council by attending in large numbers, and the guests expressed themselves well pleased both at the natural beauties of the locality and the interesting work of the Club. To those of our members who were active naturalists, working in the field with Dr. Sterry Hunt, Prof. Lawson, Prof. Saunders, Dr. Merriam or Dr. Percifer Fraser was a rare treat and an opportunity for an interchange of ideas that may never present itself again.

The visit of the members of the British Association later in the season was not lost to us. All must have been interested in seeing so many of the leading English minds personally visiting our country, and at the opportunity it afforded to become acquainted with authorities previously known only through their writings. As one result we have now been placed on the exchange list of several similar British Clubs, at whose gatherings any of our members would be certain to receive a cordial welcome should they present themselves.

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The regular Club work has been followed with the usual energy, the system of field work of the previous season being continued in this. The leaders have been actively engaged in directing their various branches, and their reports will show continued progress. The Saturday sub-excursions were well attended by their followers, especially in the early part of the season, as the summer advanced and towards its close they were only held at irregular intervals owing to the absence of some of the leaders and a number of the more active members. The general excursions were as popular as ever. The first of these to Kingsmere, with the Royal Society, I have referred to as particularly interesting. That to the Chats Falls was well attended, and though the time for exploring the surrounding country was limited, our Geologists succeeded in making important discoveries in the formations that occur there. The genial Captain Goulet's well-known generosity once more manifested itself, for he again conveyed the party on his commodious steamer. To show that we appreciate his kindness and goodwill, a set of works on Natural History are being appropriately bound and inscribed, to be presented to him. The excursions to Buckingham and Casselman also brought us in contact with distant members. At the former Mr. Warwick did all in his power to point out the places of interest in that district, and at the latter Mr. and Mrs. Casselman renewed the hearty welcome of last year.

This year the Transactions were presented to you early, and are greatly in advance of any of the previous numbers. The papers were lengthy as well as more numerous than in former years, and too valuable to be presented in abstract. In addition, the very valuable list of Coleoptera and unusually interesting reports, maintain the usual excellence of our publication. That the Council is enabled to publish such a work and keep the expenses of the Club within its moderate income, is a sign that no extravagance is permitted, it is for this reason they expect the members to support them by purchasing extra copies. Nearly all have friends elsewhere interested in scientific pursuits by whom the Transactions would be greatly appreciated, and it is by distributing a few copies in such channels that you will extend the influence of the Club and add to its reputation.

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Our library is increasing rapidly. In exchange for our Transactions we receive twenty-eight regular publications, eight of which appear monthly. Besides this our free list numbers seventy-three, and of these only twenty-three have not donated something in return. When it is remembered that all are on purely Natural History subjects and all of them modern works, it will be understood what a useful collection we are founding. The librarian is now endeavoring to adopt some scheme by which they may be circulated that all may benefit by what we possess in common.

The winter programme, I hope, will meet with your approval; the papers are fewer in number than those of last year, but more time will be allowed for discussion and short notes on any subject. In the afternoon lectures, to be conducted by the leaders of the several branches, we hope to furnish a very thorough course of instruction, specially adapted for those wishing to gain an insight into any branch, teaching you not only the science, but also how and where to look for the objects you are in search of and how to preserve them, in fact all the information requisite to commence work when the summer arrives.

The work that our Club has in view is perhaps the most attractive that can be offered to those who have a few spare hours and a desire for some intellectual recreation, and it allows of the consoling reflection that the time so spent is in no wise wasted, for besides adding to the range of one's information, it is also aiding a work of lasting benefit. The world is rapidly learning the value of this knowledge, and many are awaking to the fact that there are many interesting fields of science hidden behind the veil of ignorance, a veil which is easily drawn aside by a little study or association with those already versed in Natural History.

Any that attend our meetings or join in our excursions show their appreciation of this knowledge, and by their presence manifest a fondness for nature and a desire to learn something of its mysteries. Many, no doubt, wish they were versed in some branch, but fear to commence, they are overawed by the apparent vastness of the subject and the extensive knowledge of those who have made it their study. Instead of watching the progress of those long experienced, they should look at what there is to do and select some branch suited to their tastes and

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circumstances. The beginning once made, all will follow easily, for when viewed with method, each division and sub-division is complete in itself and leads gradually to others more extensive.

Some of our members will attain an eminence and be recognized beyond our little circle; some will build up a reputation that will extend over the American scientific world and reach transatlantic centres; but the greater number of us must rest content with a local record, and be satisfied that our mite, when added to that of others, will be made of some value. We are only amateurs and the work presented is eminently suited for such. There are large fields and small fields; some, where members have already worked and prepared the way, others, for those more ambitious, where little or nothing has been done. For those who cannot take long walks or have not time to make large collections, there are subjects that may be studied in an occasional spare hour, and which may even be studied by the roadside in the daily walks to your office. It is always beneficial to make a retrospect of one's work, to consider the advance made and compare it with what there remains to do, and on the present occasion it may not be inopportune to glance over our work to see what has been accomplished, and ascertain what remains for new workers to begin upon.

Before entering the domain of the lower animals, a subject presents itself which has not yet received our attention, but which would furnish a very appropriate paper for one of our meetings. It is not very many years since where we now live was the home of the native Indian, and a paper on this subject with some historical facts of local interest would prove both attractive and instructive. The remnant of the once numerous tribe that frequented this district is gathered in a few scattered settlements, and as each succeeding year comes and goes the opportunities of acquiring a knowledge of their natural habits and customs becomes less, and with them will pass away innumerable legends and stores of Indian lore which can never again be obtained.

Beginning at the head of the animal series the class *Mammalia* is the first to receive our attention. This comprises all that are popularly known as *animals*. Strange to say, this important division has received very little attention. A paper on the deer has been brought before you, and one on the otter will be presented this winter; beyond this,

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nothing has been done with the exception of a few notes embodied in the reports on general zoology. The need of studying this at once, must be evident to you all, as no other class is so influenced by the settling of the country ; species that once were numerous, in a very few years may be reduced to an occasional stray individual. Even now, a paper on any family would, to a great extent, be taken up with detailing how plentiful they were in former years. But while the number of individuals is greatly diminished, the number of species is much less affected. Dr. Merriam in his recent work on the mammals of the Adirondac region mentions 46 species that occur there, and Dekay, in the report of the New York State government, gives about 50. A list published in the bulletin of the Natural History Society of New Brunswick contains 43 as found in that province. In our neighbourhood we should find the class well represented. It would astonish many of our people were they aware of the good-sized animals that may be found in the woods they frequently visit, whose size it would be supposed would render them easily visible, but whose habits of life make them wary, and they easily escape the eye of the unobservant. Within very short distances of the city we may expect to find the greater number on these lists, while at no very great distance the more ferocious are constantly making their presence known, to the detriment of the farmer.

One of our first objects then is the systematic study of our mammals and the preparation of a perfect list. More is required than simply an enumeration of species, to this should be added whatever information may be gained regarding their numbers, their range, and the fact of their being permanent or only visitors. When this is prepared, then notes and papers on particular families may follow with more advantage. In this study all the information you require may be obtained from "Jordan's Handbook of the Vertebrates," and "Dr. Merriam's Mammalia of the Adirondacs." The former is now the generally accepted authority, not only on this, but also on all the classes of vertebrates, and furnishes an excellent working key. In the latter you will find the result of many years observations of a thorough naturalist in a region where the Fauna is essentially Canadian.

The next class, *Aves*, is one we are very intimate with, our ornithologists being among the most active of our members. The list

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of those observed is now very complete, numbering 203 species, and the reports of the leaders contain many valuable facts relating to the habits of our pretty songsters, but only one paper has been read, that on the ducks. A beginner entering this field has much to attract and occupy his attention. Although the list must be very complete their migratory habits allow every possibility of discovering a new species. Besides their general habits and characteristics there are many subjects adapted for special lines of observation. Their eggs and nests furnish a study of themselves; the arrival and departure of the various species is a point that is receiving particular attention just now, and to which should be given a large share of our time; their songs would make an interesting series of observations, while their power of communicating with one another would provide the subject for an excellent paper. It has always appeared to me that birds, of all members of the animal series, are the ones most suited for our lady members. It is here that nature puts on her most showy and pleasing attire, no long tramps are required to seek them in their haunts, nor any tedious work required to prepare collections. A bird may almost always be watched in its native state and a few minutes reference to the handbook establish its identity. Unlike other members of the animal kingdom, they are visitors, not residents. Some spend the summer with us and take their departure for the south on the approach of cold, while others come for shelter in the winter months from a still colder north, others again only rest a short time in journeying from one clime to another. These pretty visitors are looked on with a more friendly interest when it is remembered that they will return again after several months of wandering, and the very same bird, fed and watched one season, returns the next.

In the classes of reptiles and amphibians we find another field as yet undisturbed. We want some one to tell us what kind of turtles are to be found here, what snakes, what lizards, what frogs, and many other interesting members. For those with limited time these branches are particularly suitable, they are easily sought for and obtained and their number is not great. In a stroll to the nearest woods or along the Ottawa or Rideau rivers several species may be noticed. The whole number will not exceed 50 species. The study of their habits will

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quickly become interesting, the wonderful contrivance of nature allowing them to carry their lungs outside, that they may breathe in the water or in the air, will soon attract your attention, as will also the transitions that take place, such as the development of the tadpole into the full formed frog. This branch will also allow much scope and great facilities for original research, information regarding its members is very sparse, and a description of their life will always be valuable.

The class *Pisces* is one that has been studied and a very complete list published, but much yet remains to be done, and more workers are to be desired. The study, unfortunately, has many obstacles to impede its progress. Inhabiting, as they do, an element that cannot be explored, their habits are obscure, while their peculiar structure and delicacy of coloring make them difficult to preserve. For this reason our information regarding their life and habits is very scanty. We want members to trace their range and numbers and habits of life. A very practical point well worthy of your attention is the influence of sawdust in our rivers. Does it affect them or does it not?

In passing from the Vertebrata to the Anthropoda, we enter a most extensive and varied field, where orders surpass in numbers whole classes of the former sub-kingdoms. In addition to the study of individuals, the general characteristics are subjects well worthy of being brought before our meetings. The higher animals are so constituted that life is maintained in a single course, but in the lower, the organs are so rudimentary that the animal makes entire changes to accommodate itself to external influences. This is witnessed in the development of the beetle from the grub, the fly from the maggot, or the butterfly from the caterpillar.

The highest class, *Insecta*, furnishes a continuous series of attractions. The descriptions of the Hymenoptera read like a fairy tale. The peculiar habits of life of the bees and wasps are known to many of you. The ants, with their soldiers and toilers, their aphidian cows carefully tended and even reared from eggs, for the sake of the honey they supply, the evident language they possess, all combine to place them amongst the most marvellous objects of nature and should cause them to receive your attention. They may be found in vast numbers everywhere, but how few stop to watch them! The ichneumons, which

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deposit their eggs in the body of living insects, which, when hatched, generally destroy their hosts to sustain their own life, and the gall-flies, each of which forms a characteristic gall on its own special tree, are well worthy of your notice. The horn-tails and saw-flies, destructive foes to some of our most valuable trees, will be brought to your notice during the present course of soirées.

It is remarkable that the order Lepidoptera has not possessed more followers, the gay colours of the butterfly are generally the first attraction of the young naturalist, and all clubs might be expected to have many members working in this branch. Those who are so occupied should make it their primary duty to prepare a list of our species.

The order Diptera, comprising flies, is large and important and presents many suitable fields for beginners.

The order Coleoptera, comprising beetles, you are familiar with. All our Transactions contain papers on them, and a very valuable list was issued in our last number. In the order Hemiptera, or bugs, we want systematic workers. They occur everywhere, in water and on land, some are found only in the top branches of trees, some only in the lower, while other forms remain stationary all their days. Any one possessing house plants may follow this study most readily; here we meet with the plant lice, which are so sought for by the ants and carefully tended for the sake of their honey-like secretion. Then there are the grasshoppers, locusts and crickets that should be described, each forming a good subject for those by whom limited collections only can be made, as also the dragon-flies, and allied insects.

The class of *Myriapoda* or centipedes is not so numerous as the insects, nor as attractive, but should receive your attention as they are wholly unstudied here.

The class *Arachnida* offers you the mites and spiders. The former have received some attention and several new species are figured in our publications. The spiders are repulsive objects, but most interesting in their habits and modes of living. The webs furnish a study of themselves, ranging from special forms, like the diving-bell of the water-spider, to the common geometric web so well known to all.

The *Crustacea* are the lower division of the arthropods, forming to the waters of the world what the insects are to the land. Nine-

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tenths are supposed to exist in the sea, the remainder being found in fresh water. Numerous not only in species, but also in individuals, they are found in every pool of water or collection of moisture. They live on animal matter and are active scavengers of our waters. Some are parasitic on other animals inhabiting their element—a favorite place to obtain many forms being the gills of fish. In their turn they are the chief food for our fishes. Nearly all are microscopic, but a few forms grow to a great size, the most familiar of which is our cray-fish, and these would make an excellent beginning for observations in this class.

Of all the sub-kingdoms the Mollusca is the one least represented with us, the term being equal to Vertebrata or Arthropoda with their vast number of species. But two of its classes, *Gasteropoda* and *Conchifera*, are present, the combined number of their species collected being only 116. This is not for want of work on the part of our conchologists, as it is one of our most thoroughly studied branches, but because the land and fresh water contain but few members of that division, so abundantly present in the ocean. The collections in this branch are not difficult to make, and to those who wish to study their habits they offer special inducements, for an aquarium and a handful of snails will supply all the necessary material for a long series of experiments.

In passing beyond the divisions enumerated we come to those lower forms of animal life, the study of which may hardly be in keeping with the title of our Club; with the exception of one class all are microscopic, and so demand work confined to the library rather than to the field. But there may be many who find this more suited to their tastes and circumstances, and to each a varied and attractive world is opened, from which might be produced papers most acceptable for our meetings. The only member who brought this subject before our notice was the late Dr. Kemp, who presented a few notes on the fresh water sponges, and referred incidentally to some members of other classes in a paper on the filterings of our water supply.

The *Annelida* form a class well worthy of your attention and are known to you through the common earth worms and leeches.

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The *Rotifera* form a very numerous class, the great majority inhabiting fresh water, the number found in salt water being comparatively small. They are to be found everywhere, in little pools or large bodies of water and by their presence indicate its freedom from the products of decomposing matter. The characteristic feature of the little animals is a circle of processes arranged around their head, each one performing a circular motion, the whole giving the appearance of a wheel revolving around the head.

The marine jelly-fish are represented by two forms. The best known being that many armed minute monster, the *hydra*, which, when cut in pieces, grows into as many fully formed individuals. It is very plentiful, and may always be obtained from the muddy bottom of the canal. The other form is more uncommon, its arms are many branched and it remains anchored to other objects, this species grows as much a two inches in length and in all probability will be found here.

The fresh water sponges form a sub-order of that extensive class; some ten genera have been described from all quarters of the globe representing a great many species. They occur in clear water and grow to a considerable size, though the cold of winter always destroys them.

From these we descend to the single-celled animals, to which the term *Infusoria* is properly applied. They are present in all water and moisture in countless numbers and furnish a vast field for study; researches in this class has been mostly confined to Europe, the American forms have scarcely been worked at all.

Still lower are the *Protozoa*, soft, structureless animals without shape or form, known to you by the amœba. They are innumerable and occur everywhere. It is a class that has received much attention on this continent, and the recognized authority is Prof. Leidy's recent work on the Fresh Water Rhizopods of North America.

This superficial glance over the vast and varied region, the animal kingdom, thrown open for us to wander in, is given with the hope that knowing what there is to be done, in learning how many attractive fields there are yet without workers, some others may be induced to take a more active interest. Each year should see an addition of new members eager and ambitious to continue the work and act as a spur to those already engaged. Our first requisite is a complete catalogue of

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all the objects of Natural History that occur in the adjoining country. Among the lower forms of life the difficulties are so great that the prospects of obtaining this end are very dim, but with this exception there is no reason why we should not become thoroughly acquainted with our resources. To accomplish this we want leaders in every class and in many instances we need workers devoted to particular orders or families. It is not necessary that the first lists should approach perfection, any list is better than none, once commenced they are centres which will rapidly increase, and form starting points where others may begin, while an incomplete list will—from its very defects—prove an incentive to many to bring it to perfection.

A natural outcome of all intelligent collecting, beginning with the first efforts in that line, is the developing of the power of observation. Things that before were passed by unnoticed now attract attention and the many relations that natural objects bear to each other are discovered. This is the source of the attraction with which this science retains its followers, without it the hardest worker can never become a naturalist, and rarely continue a steadfast student.

That this power may not be wasted notes should be made of all observations during the preparation of lists, for a record of a series carefully followed is the matter we require for our papers and must mainly constitute our offerings to science. Every fact is of value, whether it be general in character or refer to some particular local condition. Notes of local interest, by themselves, may not appear of much importance, but when compared with similar observations from other sources, may prove of the greatest value and may tend to add to our knowledge of faunal distribution, that very important phase of the science of Natural History.

Our work must not end with the perfecting of our lists and publication of scientific records, something more is required of us in this practical age, which it is our duty to furnish. We must be prepared to answer the question which might be put to us by the captious—of what practical use is the Club? Our response to this should be found in the Transactions; there the agriculturalist should learn what are the pests that destroy his crops and how they may be conquered or prevented; the speculator should be able, from their perusal, to obtain the

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information that directs him to the mineral deposits that are to be found. In the papers to be read to you, this will, in a great measure, be carried out, and in our notes and discussions it would be well if this practical end were kept in view.

Prof. Macoun said that when the President of the Literary and Scientific Society in his inaugural address a few days previously had stated (when referring to the Club) that the mere collection of a great many species should be but a small part of the work of the Club he had quite agreed with him. But it should not be lost sight of that collections were of great value, for the work performed by any naturalist would to a great extent die with him if his collections were not placed in a museum. He had, for instance, a knowledge of several hundred species of cryptogams, but a list of these without the possession of the specimens would be of little value. Each collector should deposit duplicates where they would be accessible to every one for study and comparison.

Mr. H. B. Small alluded to the great value of such a collection, for instance, as one of insects injurious to crops, showing the species destructive to the various plants, as well as the insects which prey upon these injurious ones. There was in Washington such a collection as he had described, and he hoped soon to see one in Canada. With reference to the appointment of Mr. Fletcher as Government entomologist, referred to by the president, he could give a practical instance of the value of such an officer. Specimens of very fine grains intended for the Antwerp Exhibition were condemned by him as unfit, and if sent they would have brought discredit upon the country.

Mr. R. B. Whyte said that the small resources of our societies rendered it difficult to sustain a museum, and that while it was perhaps posible to overestimate the value of a public museum it was probably too often the case that private collections were undervalued.

Mr. W. L. Scott thought that not more than twenty-five reptilia and batrachia could be looked for in the vicinity.

The President explained that the number mentioned by him had been suggested by Dekay's list of those found in New York State.

Mr. Harrington explained that many species found there could

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not be look for so far north as Ottawa, and he was disposed to consider Mr. Scott's figure large enough to include all the species likely to be found in the vicinity.

The PRESIDENT stated that he believed this number of species had already been noted.

THE CANADIAN OTTER.

WILLIAM PITTMAN LETT.

Read 18th December, 1884.

The Canadian otter (*Lutra Canadensis*), of which I am briefly to treat this evening, like the wapiti and the wild goose, derives its distinctive designation from Canada, over every part of which, as at present constituted, it is distributed. It belongs to the Mustelidæ, or weasel family, and genus Lutra; of which interesting group of our indigenous mammalia it may be said to stand at the head. With the exception of the black and silver grey fox, the otter is by far the most valuable fur-bearing animal to be found in Canada. Its fur is thick and fine next the pelt, with longer and coarser hairs of uniform length of a glossy dark brown colour, inclining in old animals to greyish, around the under part of the head and belly. Above all other kinds of fur that of the otter is extremely durable, and the darker it is in colour it is the more valuable. I have known an otter-skin cap to have been worn for thirty years, winter after winter; and although somewhat faded in appearance, after frequent repairing and periodical remodelling, the skin was still strong and tough, and the fur by no means worn out. Plucked-otter, dyed, is almost as beautiful as South Sea seal, with the advantage of being much more lasting. Otter-skin coats, caps and gloves are always costly articles of apparel, but when the beauty and durability of the fur is considered, they are always worth the money. From the nose to the tip of the tail a full grown otter measures five feet. The body is thick, compact and muscular. The eyes are small and black in colour. The head short and flat. The teeth are fine and sharp. The neck long and thick, the legs short, and

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feet entirely webbed to the nails. The tail, which is somewhat elliptical in shape, rather than flat, is broad, thick and powerful at the root, from whence it gradually tapers off to a point. This massive and muscular tail—which is about eighteen inches long—acts as a rudder, and aids the animal in its rapid turnings when in pursuit of fish, upon which it principally feeds, although not exclusively; for the otter is fond of eating any kind of flesh, especially that of birds. It is said that these animals make considerable havoc among wild ducks, which they can easily surprise and capture by diving underneath them and seizing them by the legs. An adult otter of the largest size weighs about thirty-six pounds. The average weight, however. may be estimated at about twenty-five pounds.

The otter is, perhaps, the strongest and most muscular animal of its size living. In its wild state it is extremely shy; but when cornered beyond the possibility of escape, it is singularly bold and ferocious. Singly, very few dogs can match a large otter. Like many other individuals of the *feræ naturæ*, which are naturally fierce in their wild state, when domesticated the otter is gentle and docile to an extraordinary degree.

Strictly amphibious, yet chiefly aquatic in its habits, and physically constructed rather for navigation than pedestrianism, the otter, as swimmer and diver, is scarcely second to the seal or the walrus. Amongst the digitigrade carnivora of America no animal of the same size possesses so much muscular power, and few, if any, wear so costly a garb.

Although similar in size and appearance to the otter of the British Islands, the skin of which is of little value, the coldness of our Canadian winter naturally imparts its superiority and commercial value to the skin of the Canadian otter.

As yet, otters have never been hunted in this country with packs of hounds (a cross between the large wiry-haired terrier and the fox-hound) as in the old country. They are invariably taken in steel traps set in the water at the entrance to their dens, or at the foot of their slides, and frequently also at "air-holes" in the ice. During the season of open water, in setting his traps for otters, the hunter, if he can avoid it, never goes on land. While at this work he remains in

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his canoe, lest his footsteps, or the touch of his hand might leave any traces of the scent of an enemy on shore. A long chain is usually attached to the trap, the weight of which is intended to drown the animal when it plunges into deep water on finding itself caught. Otherwise, it has been frequently known to gnaw it's paw off and escape. When surprised alive in a trap on land, as sometimes occurs, an otter is exceedingly ferocious and difficult to kill. Its strength and activity under such circumstances are amazing.

I extract the following on the otter from "Mammals of the Adirondacks," a recent most interesting and instructive work written by that accomplished naturalist, Dr. Merriam, of Locust Grove, in the State of New York. I quote from Dr. Merriam, not only because he is an established authority as a naturalist; but also for the reason that his remarks are generally strongly corroborative of what I shall say further on; and which was written before I had the pleasure of seeing his valuable book. Of the otter Dr. Merriam says :—

"It is thoroughly amphibious, making long journeys through the forest, and swimming the lakes and rivers. It can remain under water almost as long as a loon, and I have known one to swim nearly a quarter of a mile without showing its head above the surface. Its food consists chiefly of various species of fish, and the lobster-like fresh water decapod, called the cray-fish. When unable to procure these in sufficient quantity it devours frogs, and it is said to depopulate the poultry-yard, and even to prey upon young lambs. It can dive and swim under water with such speed and rapidity, that it can overtake and secure with great ease and certainty any of the fresh water fishes. In confinement it will eat meat, and is said to prefer it boiled. The number of cray-fish (*Cambarus*) that the otter destroys in the course of a summer, is almost incredible. The otter "sign" that one finds so abundantly about our lakes and streams, on rocks and logs, often consist wholly of the chitinous exo-skeleton of this crustacean. At other times fish-bones are mingled with the broken cray-fish shells. Otters are restless creatures, always on the move, and are constantly roaming about from lake to lake, and river to river. They sometimes go from place to place "just as it happens," so to speak; while at other times they

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travel in definite routes, following one water course for a number of days or weeks, and returning by another.

"The nest of the otter is generally placed under some shelving bank, or uprooted tree, and has been found in a hollow stub. The young are commonly brought forth about the middle of April, and two (rarely one or three) constitute a litter. Three otters, the female and her two young, are generally seen together during the summer and fall.

"At all times and on all occasions they manifest an insatiate and uncontrollable desire to break the peace with any dog that chances to cross their path—and woe to the unfortunate brute!"

The extraordinary pugnacity referred to by Dr. Merriam may possibly occur in certain cases, and may, perhaps, be superinduced by age. With domesticated otters up to the age of two years, so far as my daily experience has enabled me to form an opinion, I am obliged to pronounce their demeanor towards dogs to have been of the most friendly and pacific character. On every occasion both of my pet otters were almost affectionate in their advances to their canine friends. I have heard also of other tame otters that had been kept for a number of years, at least four or five, that bore a character of the mildest kind under the circumstances. Wild otters, of course, are always ready for a fight.

Essentially differing from nearly every other species of the family *Mustelidæ*, the otter is peculiar for the total absence of that mephitic and unpleasant odor which so strongly characterizes the skunk, the mink and the weasel. Even the apartment in which an otter has been confined for months is completely free from anything resembling the heavy, disagreeable smell of a dog kennel.

From personal observation I can fully corroborate Dr. Merriam's account of the exterminating manner in which the otter levies contribution upon the cray-fish. In the course of half an hour either of the tame otters which I kept would capture and devour fifteen or twenty of those little fresh water lobsters. They were, also, very fond of mussels, or shell fish, so common in our rivers, diving for them and bringing them to me on shore, and waiting with much impatience while I broke them open with a stone.

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Respecting the otter eating frogs, I shall give my experience upon this point presently. When other and more agreeable food is scarce, the animal, driven by hunger may, and possibly does, prey upon frogs in its wild state; but nothing is more certain than the fact that when partially under the restraints, and influenced by the etiquette of civilization, the taste for music in this connection is by no means epicurean.

In India and China otters are taught to fish, and when expert they are let down out of boats with a rope or small cord fastened to them, by means of which they are drawn back into the boat when they have caught a fish. I never found this kind of a safeguard necessary. If one of my otters was in the water and I left the shore or hid from view the instant it rose to the surface it came to land and went in search of me.

The otter usually burrows in the banks of streams, or, if not, appropriates the already excavated den of the muskrat. The entrance to its den from the side of the river, creek or lake is always under water. About three or four feet inwards from the external or lower entrance the hole inclines upwards to a sufficient height for the formation of a dry nest to sleep in. From the sleeping-place an opening is made obliquely through the top of the bank for the double purpose of admitting air and of allowing the passage of the animal in that direction. Advantage is constantly taken of this upper and second mode of exit, which is sometimes concealed by fallen leaves, for the purpose of looking out in order to be certain that no enemies are near.

The sport of sliding, amongst animals, I believe, is peculiar to the otter alone. Otter-slides down the face of steep banks may be seen in both summer and winter. Upon those slides the playful animals amuse themselves for hours at a time, much in the style of taboganning. I spell and pronounce this fashionable word according to the orthography and mode of accentation of Chief Mayaskawatch, late of the tribe of the Algonquins, of which aboriginal branch of the red men of America I have the distinguished honor to be a regularly baptised and duly initiated member. According to the traditions of my tribe, the tabogan was first suggested to the Indian mind by the otter gliding down his slide. The tabogan and the bark canoe are both purely Indian inventions, so perfect in their model and construc-

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tion, and so admirably adapted to the purposes for which they were originally intended that no white man has yet been able to improve upon either of them. Like the boomerang of the native Australian they are perfect and insusceptible of improvement.

In the act of sliding, the otter, after a few rapid jumps to gather momentum, stretches himself at full length, with his front legs drawn close to his sides, and his hinder legs stretched out on each side of his massive tail, and on his belly down he goes, if the season be winter, sometimes forty, fifty or a hundred yards, according to the height of the hill. When the ground is free from snow the slides down the bank are not usually more than twelve or fifteen feet. In travelling over ice barely covered with snow or hoar frost the otter generally takes three long bounds and then slides along the smooth and level surface a distance of twenty feet, continuing this mode of travelling for miles. The process of sliding appears as if it gave the animal a rest, as well as its usual amusement, between each succession of jumps.

On account of the shortness of its legs the otter makes very slow progress in deep snow. If the snow has recently fallen and remains in an unconsolidated state, if pursued, it dives under the surface and in an incredibly short space of time may be seen popping up its head twenty or thirty yards off to reconnoitre. After taking an observation down it goes again, regulating its direction by the position of its enemy. If the snow happens to be heavy and closely packed this mode of progress fails and its movements are slow and labored. It can then be easily overtaken by a man on foot; but when overhauled it makes a fierce resistance and a determined battle for its life. It is a well-known fact to those acquainted with its history and habits that the otter in its wild state is fully as fierce, and, under any circumstances, as courageous as a bulldog, and almost as skilled an adept at fighting. Owing to its short legs, on land the gait of the otter is awkward, although a little too fleet for the time of the fastest pedestrian. In water its motions are simply the perfection of ease, grace and elegance. The lightning rapidity of its sinewy plunges is almost beyond belief.

In the pursuit of fish for food the otter does not depend entirely upon its extraordinary speed; nor does it always catch its prey by what might be called a tail on end race. It approaches its intended

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victim from behind with great caution. It stretches itself at full length, as when sliding, and with its short front paws paddles itself slowly and stealthily along with its body perfectly motionless, no movement being perceptible but the gentle action of its short fore legs. When within about eighteen inches of its unsuspecting quarry the pursuer arches up its back, like the bending of a bow, and with the speed of an arrow darts upon its victim, seldom failing to seize and secure it at the first plunge. Should it fail in the first attempt, providing the water is clear, the chase is continued, very generally with success. Otters are very destructive to fish. When abundant in a stream they eat a small portion only of each one caught; but when scarce and difficult to find they usually devour the entire body. A full grown otter is quite capable of catching and killing a fish twenty pounds and upwards in weight, either pike, maskinonge or salmon; but I am inclined to the belief that it prefers fish of a smaller and more manageable size.

Otters are extremely fond of cray-fish; but, strange to say, they are not lovers of frogs. After frequent trials I never could induce either of my pet otters to eat a frog, although they were by no means slow at killing them. When fish was not available both of them were satisfied with bread and milk, meat or potatoes. They were, also, always ready for fresh fish or salt, if allowed, of any kind, raw or cooked; although they always preferred getting them living, if possible.

In a domesticated state otters are very docile and playful animals They will follow their master like dogs, literally answering to their names when called. They have two notes or tones of voice, one a sort of satisfied grunt, like that of a pig, the other a shrill half squeal half whistle. The latter is given short and sharp and with peculiar vindictiveness of tone when they are enraged. They are singularly fond of playing with dogs, more especially with water spaniels, with which animals they delight to frolic in the water. In common with dogs, otters appear to have an intuitive knowledge or consciousness of the dispositions of people who either like or dislike them, and exhibit their love or hate at first sight After a close scrutiny of a stranger, if the impression is favorable they act accordingly, if otherwise they display their repugnance forthwith by an angry whistle, which is invariably

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the warning prelude of an unpleasant application of their teeth, most commonly to the bare hand, which they manage to reach by standing erect on their hind legs.

As I have before remarked, tame otters are remarkably fond of dogs of every kind. They seem also to possess the power of exercising a strange fascination over the whole canine race. The conditions are as follows. When a tame otter meets with a strange dog it advances quietly and insinuatingly towards it with a singular serpent-like motion of the head and neck. When close enough the otter endeavors to smell the nose of the stranger. If the dog undergoes this operation quietly for half a minute it is conquered and immediately transformed into a friend, no matter how hostile or uncertain its first intentions may have been. I have seen an Irish water spaniel eight years of age playing around the yard for hours with one of my pet otters in a friendly manner that nothing could induce him, at such an age, to assume towards one of his own species. This mesmeric power of the otter, so far as I know, is a new idea for zoological students, which is no less strange than true. It is a species of animal magnetism which I have frequently seen exercised with unfailing influence and certainty. Another fact may be worth relating. As they sometimes do with members of the human race, I have never seen tame otters manifest any dislike at first sight to dogs; and never that I have authentically been able to learn, do they show any disposition to quarrel or fight with dogs unless first attacked; and then "the tug of war" requires a Spartan in the canine foe. In such a case, even with dogs, their apparent affinity, they become bitter, unrelenting and revengeful, until they have taken vengeance upon their assailants, after which they are always quite willing to establish friendly relations with their antagonists.

With very little trouble I taught both of my tame otters, "Pontiac" and "Pocahontas" to fetch from water; at which accomplishment, for quickness, no dog was a match for them. Their mode of fetching was entirely different from that practiced by dogs. They plunged under water and reappeared at the exact spot where the object thrown out for them to fetch floated, which they seized and brought under water to the shore. With a persistent system of instruction,

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and the exercise, perhaps, of much patience, an otter might be sufficiently educated to make a good retriever from water. If his capabilities could be developed to their utmost, the sportsman, on open water, could do without a gun. The chief difficulty would be to prevent the animal from mutilating the game, which, unless taught otherwise, it would be liable to do.

In this connection I remember an incident in which Pontiac was the chief actor. I was sitting a short distance below the Queen's Wharf on a Thursday evening, while Pontiac was disporting himself in the water. Generally, on such occasions, we used to be favoured by twenty or thirty spectators. On the evening in question we were alone. About thirty yards from shore a fisherman came along with a canoe load of fine pickerel for market next morning. I requested him to sell me a string of fish. He agreed to do so if I went to the market next day. In the meantime Pontiac had stretched out his neck and winded his game. He then quietly disappeared under water, and came up on the outside of the canoe, into which he climbed; and having secured one of the best strings of pickerel without having been noticed by the owner, he dropped into the river, and with his plunder, soon made his appearance at my feet, to the profound astonishment of the fisherman. It is needless to say that I had no difficulty in persuading that fisherman that it was actually necessary that he should dispose of that particular string of fish. I had a peculiar method of enforcing obedience, therefore I experienced no difficulty in inducing Pontiac to relinquish his plunder. By experience I had discovered that the most effectual mode of mastering an otter was to seize him by the tail and raise him from the ground. When thus suspended, well out from the side, the otter is powerless, although a little too heavy to retain for any length of time at arm's length.

On another occasion Pontiac robbed a careless citizen of two or three pounds of beefsteak which he was carrying home from market. After perpetrating the robbery he ran off with his booty, and concealed himself amongst some thick cedars which grew in front of the house, and could not be found until after he had finished his banquet. Pontiac was a perfect terror to cats. Whenever he could catch an unfortunate member of the feline race, a short, sharp and decisive line of

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action followed. Poultry, also, to use the language of the venerable African, had to "roost mighty high" when Pontiac was round. From this fact you may naturally conclude that hens and otters cannot advantageously be kept at large on the same premises. Next to fish, Pontiac had an unconquerable partiality for fat chickens, irrespective of plum age or pedigree.

Pontiac knew his name, always came when called, and followed his master on the street, or in the woods, as faithfully as a dog. One evening in summer I started in a bark canoe for "Brighams's Creek," leaving Pontiac on shore. Apparently in great trouble, he immediately began whistling, and started after me swimming on the surface of the water, seeming as if afraid of losing sight of me. When he found that he was losing ground—or rather water—he concluded that a desperate alternative was necessary; and under he went, and in less than two minutes, all dripping with water, he was on my back. The afternoon was warm and I did not mind the wetting.

Pontiac had a nose as keen as that of a highly bred hound or pointer, both of which dogs, in extreme sensitiveness of smelling, excel the setter. In our rambles, when we chanced to get into a cedar swamp, which was quite frequently the case, I have seen him running on hare-tracks with the spirit and vivacity of a beagle or a harrier. On such occasions he has been often upwards of half an hour at a time out of sight. When wanted, a call or two would bring him out instantly, and no matter how winding or circling my track might be to a hiding place, either on snow or on bare ground, he followed it with the precision of a blood-hound, whistling almost at every jump to let me know that he was coming.

Notwithstanding his apparent craniological defects, Pontiac was singularly sagacious; so much so, as to constitute a living contradiction to the dicta of phrenology. In his flat, serpent-like head Prof. Fowler would find it difficult to imagine where there was room for brains. His organs of alimentiveness and destructiveness, however, must have been fully developed, a fact which cats, fishes and poultry, if they could speak, would amply confirm.

My other little otter, "Pocahontas," I regret to say, died young, from the effects of a blow on the head from a stone; an unlucky inci-

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dent which, perhaps, happily for the offender, I did not witness. The occurrence was annoying, and the loss to me considerable. Pocahontas was an accomplished capturer of fish; so much so, that had she lived to become two years old, my rod and line might have been entirely dispensed with, and the ichthyological branch of sport left altogether to her. After having taken and devoured about thirty cray-fish, on the day preceding that on which she was assassinated, she caught in the evening three fine pickerel to the surprise and admiration of a crowd of spectators.

At two months old Pocahontas commenced her piscatorial studies by catching minnows in a large tin dish—then went through a course of cray-fish—then advanced to rock-bass and chub, ascended then to pike and suckers, and finally went through the higher branches of a finished education by graduating with distinguished honors in the epicurean curriculum of black bass and pickerel. I had taken great pains and trouble to develop her natural instincts; and had she not met with such a tragic end, I feel certain that her future performances under water would have proved marvellous.

I am done. If I have been able to interest my audience. If I have advanced a single theory, or related a single fact hitherto unknown, or unpublished, in relation to the Canadian otter, I shall feel happy to think that my connection with the Field Naturalists' Club of the City of Ottawa, means something more useful and something better than one of a mere honorary character.

Mr. W. L. Scott wished to call attention to a valuable series of otter skins kindly loaned by Mr. Devlin for inspection, and including raw, dressed and plucked Canadian otter, as well as a beautiful example of the sea otter (*Enhydra lutris*) for comparison with them. Mr. Devlin had informed him that the most of his skins came from the Upper Gatineau and Lièvres, about 100 miles north of Ottawa, and that they were only equalled by those from the northern parts of British Columbia. Skins from Manitoba and the North-West were larger, but coarser and less valuable. Those from the upper Ottawa were not so dark or rich in color as those from the upper Gatineau, while those obtained south of us were light and poor and only worth

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half as much. He (Mr. Devlin) bought annually from 400 to 500 skins. The value of the otter skin fluctuated less than that of most furs, and ranged from $4 to $15, according to size and quality. The sea-otter skin is much larger and very much more valuable than that of our own species. That animal, besides being much bigger, had the feet also more webbed, and differed in its dentition and in other points so much as to be placed in another genus. Its range is now northward from British Columbia along the Pacific coast. The European otter (*Lutra vulgaris*) was smaller than the Canadian, but had a longer tail.

Mr. ANDERSON said that his friend Mr. Noble had informed him that he had frequently trapped "sea-otters" on the shores of the north of Scotland, and he wished to ask if these were the true "sea-otter;" for if so its range was not so restricted as had been stated.

Mr. NOBLE then described the manner in which he had captured the so-called "sea-otters," and from his description it was apparent that the animals in question were merely coast-frequenting specimens of the common European otter.

Prof. MACOUN and Mr. J. B. TYRRELL gave very interesting accounts of the occurrence of beaver, otter and muskrat in various districts of the North-West, but differed as to localities producing the best skins.

Mr. WHITCHER referred to Mr. Lett's mention of the otter preying on ducks, and stated that he had seen an otter come up and sit on the rocks along side of ducks, and that the birds did not apparently mind him, although the appearance of a mink would have made them all fly. Possibly this was because the otter seizes his prey from beneath the water and therefore the ducks do not recognize him as an enemy on land, whereas it is there that the mink attacks them. He had killed on one occasion six otters on the Constant creek (about fifteen miles above the city). He had observed that the otter, viewed from above, when swimming under water looked surprisingly small, owing to the dark color of its back tending to render it almost invisible.

Dr. BELL explained that the quality of the furs from the North-West did not depend altogether on the latitude. The animals inhabiting the open plains were lighter in color than those in the mountain and wooded districts.

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MINERALS OF THE OTTAWA DISTRICT.

CHAS. W. WILLIMOTT.

Read 15th January, 1885.

It will be unnecessary to enter into any introduction, more than to define the limits expressed in the title as the Ottawa district. As my own observations have extended only over portions of the three neighboring townships, Templeton, Hull and Wakefield, and having a strong aversion to indirect information, I think perhaps it might be best to concentrate our views to this area, and even to do justice to these three townships would require a far more voluminous treatise than our available space will permit.

About sixty minerals are found in these three townships, many of which are not rivalled in the Dominion. It is doubtful whether the same extent of country elsewhere in Canada can claim one half that number.

In bringing together such a large variety of minerals in such a limited space I must necessarily curtail many of their features, and, indeed, little more than giving a general outline, touching on their more important characters, is all I can expect to accomplish.

Each mineral will be treated separately, giving at the same time the lot and range, or the name of the mine at which it occurs, so that those interested in this science may have an opportunity of testing the merits of this paper, as well as forming an introduction to the minerals of our neighborhood.

We shall first consider the metallic minerals, foremost of which is native gold.

Native Gold.—The only instance of the occurrence of this metal is based on the authority of the late Mr. H. G. Vennor, who obtained a specimen from Capt. Cates of the Péche village. It was said by the latter gentleman to have been picked up during a journey through the woods on the east side of the Gatineau river, in the township of Wakefield. The mineral, which I had the pleasure of seeing, consisted of fine visible native gold in a ferruginous quartz, associated with green apatite. This specimen assayed, gold, 11.725 ozs. to ton, silver, 52.323 ozs. to ton

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Lead and Zinc.—The only representatives of these metals observed in our district are the two sulphides, galena and blende. These minerals are found associated in a greyish-white crystalline garnet that occurs in lenticular masses in a crystalline limestone on lot 6 of the 1st range of Wakefield. The blende, which is in black, shining cleavable masses, is often so intermingled with the galena as to give, apparently, more prominence to the latter mineral, a feature that must ever be guarded against by intending speculators.

Copper.—The only mineral representing this metal is the yellow sulphide (chalcopyrite) found in specks and small imperfect crystals in some of the veins of the apatite mines.

Iron.—Under this heading we shall, for the sake of convenience, include both the oxides and sulphides of this metal, viz, magnetite, hematite and varieties, limonite, pyrite and pyrrhotite. The magnetic oxide, or magnetite, is found in more or less quantity in the above townships. The more workable deposits, however, so far as our present knowledge goes, lie in the township of Hull, where mining operations have been carried on at intervals for the last thirty years.

The ore coming from these mines is coarse in texture and is often traversed by veins of red hematite, besides occasionally enclosing scales of graphite and mica. Lenticular patches of this ore occur in a dark green pyroxenite on the south half of lot 7, in the 1st range of Wakefield, and also on the north half of the same lot it fills a vein in limestone. The outcropping portion is highly crystalline, and owing to the crumbling nature of the walls good crystals often variously modified may be obtained.

The variety known as specular iron ore occurs at the Haycock location in Templeton and Hull. According to Dr. Harrrington it is in parallel beds in a highly feldspathic gneiss. This ore is often mixed with the magnetic oxide, and often to such an extent as to almost wholly replace the former. A white granular apatite, and a translucent variety of greenish fluor are often associated. The finest crystal of specular iron found in Canada came from these mines.

The next iron ore noticed (although probably not in sufficient quantity to be available for practical purposes) is a vein of limonite of about 1 foot wide, resulting from the alteration of iron pyrites.

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Flanking this vein is a less altered pyritous substance enclosing black shining crystals cf tourmaline.

The variety bog iron ore is found in several places in Templeton and Hull. But the area covered by this mineral has yet to be ascertained.

We now come to the two sulphides of iron, pyrrhotite and pyrite. The former, by far the more uncommon, occurs in small veins and masses in some of the apatite mines. The latter is much more abundant, and is rather an objectionable than a desirable substance.

It frequently permeates apatite deposits, often to such extent, as to detract greatly from the commercial value of the latter. In some of the apatite mines, large bedded masses of this mineral occur, enclosing various minerals, the most noticeable of which are crystals of apatite nd scapolite with their angles more or less rounded. At other times it is evenly distributed through large deposits of apatite. To enumerate all the physical characters exhibited by this mineral would be both endless and useless. I shall therefore select from a few places, this mineral that offers various physical characters. At Haldane's mine in Wakefield, large bedded masses of pyrites were penetrated in sinking their deep pit, often enclosing rounded green crystals of apatite, and a rusty brown scapolite. During the progress of oxidation of the pyrites, the latter mineral (scapolite) only, is affected, the apatite in all cases retaining its original color, even when partly liberated by the disintegration of the pyrites. This locality has afforded from time to time, fine brass yellow crystals of this mineral, exhibiting such faces as the cube, octahedron, dodecahedron and other modified forms.

At McBryde's Mine, in the same township, this mineral is found associated with blende, galena, garnet, &c., in bronze-brown masses, which might, at first glance, be taken for pyrrhotite, but which, however, is not magnetic.

At the Jackson Rae Mine in Templeton, large quantities of this mineral have been extracted, graduating in color from a brass-yellow to almost grey. Sometimes thin coatings entirely envelope apatite crystals.

Molybdenum.—The sulphide of this metal (molybdenite) has been detached in small foliated masses at McBryde's Mine in Wake-

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field. This mineral, until within the last few years, commanded a very high price; even as much as $4 per pound being paid for it. At present it is scarcely saleable at any price. It was formerly used in the production of a blue color for calico printing, which is now superseded by the bright and less expensive aniline colors.

Graphite or Plumbago.—This mineral bears a strong resemblance to the above mentioned molybdenite, physically, although to the accustomed eye it presents some points of difference; its lustre is scarcely ever as bright, and does not give the peculiar greenish streak on porcelain. But I doubt whether those characters would be conducive to its ultimate recognition. And I think, perhaps, in all cases it would be better, at least more reliable, to test it chemically. The disseminated foliæ of this mineral may almost be considered as a constant inclusion in the various bands of limestone and pegmatite that traverse these townships, in, however, as far as my observation goes, insufficient quantity to be available for practical purposes. On Lot 7, R. 1, of Wakefield, lenticular masses of serpentine enclose this mineral in foliated masses and disseminated foliæ. On the same property a fine granular variety, somewhat similar to the Cumberland plumbago, occurs in pockets of a crystalline limestone.

Apatite.—The elucidation of all the characters, physical as well as mechanical, that so conspicuously characterize this important mineral, must necessarily be attended with many theoretical ideas which will ever present themselves to the practical observer. It is a stupid idea, and yet rather a prevalent one, that the various products in nature must conform to the formulæ laid down by man. As practical observers can we reject such chains of evidence, linked as they may be by actual facts, because intricate nature will not divulge her secrets to an imaginative mind, I say no. If the existing laws that govern the chemical nature of minerals are not conformable with man's ideas, then all I can say is, so much worse for the man. For assuredly, the various gradations that mark the progress of alternation and dissemination of minerals will ere long (assisted by the all powerful microscope) crush out of existence many wild and exaggerated theories. So leaving the origin of this mineral (apatite) to the investigators of the near future, we will pass on to some of its physical characters. No mineral in the Ottawa dis-

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trict is perhaps better known, especially the freshly fractured specimens. Out-cropping veins or beds are seldom so conspicuous, being generally made apparent by a whitish weathering, and might easily be passed over unnoticed. The similarity existing between pyroxene and apatite has often been the cause of much annoyance to the pseudo-miner. The mineral, locally known as phosphate, is found of almost all shades of color, from white to almost black, passing through various shades of green, red, yellow, and blue, the last color being by far the most uncommon. Small prisms of this color are sparingly dispersed through a disintegrating coarse crystalline limestone on the south half of lot 7, range 1, of Wakefield. The yellow variety occurs in crystals two inches in length, associated with oblique rhombic prisms of pyroxene, on lot 14, range 1, in the same township. The black, or dark-greenish variety is found in nuggets of a slaggy appearance, with pitted surfaces, at the Jackson Rae Mine in Templeton. The white is generally confined to the granular varieties, known as "sugar phosphate," but rarely occurs in a state of absolute purity, being more or less mixed with the coarse cleavable mineral. A dark-green granular variety, impregnated with iron pyrites, forms a large deposit on lot 12, range 1, Wakefield.

The green and red varieties may be regarded as the predominating mineral, and in many of the mines the two colors are interblended, which feature may continue through the entire mass. At the Jackson Rae Mine in Templeton, and at a pit known as the "Spring Mine," a quantity of a beautiful, translucent, sea-green apatite has been extracted comparatively free from foreign inclusions. A very pure reddish mineral, assaying as high as 86 per cent of tribasic phosphate of lime, occurs in bedded masses at Gemmill's Mine in Wakefield. A block, estimated at 4 tons, was blown out by a single blast from one of the masses. "Moore's Mine," in the same township, is remarkable for the abundance of crystals that have been extracted during the last four years. Huge crystals, hundreds of pounds in weight, have been met with imbedded in a pink cleavable calcite.

When visiting this mine two years ago, a beautiful vein of interlocking crystals of a translucent sea-green color, had been developed. The gangue formerly surrounding these crystals had been dissolved to

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the depth of one foot, giving great prominence to these forms. But owing to their frangibility and easy cleavage, they could rarely be removed intact.

We may certainly infer from this that the phosphate mineral is less acted upon than the surrounding limestone, and yet, if these crystals are entirely liberated and exposed to a moist atmosphere they soon undergo disintegration.

The rounding of the angles of these crystals has drawn forth many theories respecting their disfigurement, fusion being offered as an explanation by some mineralogists, whilst others attribute it to a solvent action. Now, whether we adopt the igneous theory, or that of partial solution, serious objections may arise to refute either. In the first instance, minerals easily fusible and yet preserving their sharpness of outline, are found associated with rounded crystals of a less fusible apatite. Then again, we meet with rounded crystals of pyroxene (although much more rare) imbedded in limestone, also enclosing rounded crystals of apatite. Now, it is hard to understand how the apatite and pyroxene alike should be attacked by the action of a solvent, when the latter mineral is almost insoluble. Some aluminous varieties are, however, decomposed with great difficulty by sulphuric acid at the temperature of 250° c. It frequently happens that crystals of apatite assuming sharp angles are indiscriminately mixed with others that have been rounded, imbedded in the same limestone. On the other hand it rarely happens that crystals lining the walls of fissures have their angles rounded, although frequently one or more of their faces are obliterated or otherwise contorted, probably due to an interrupted crystalization. Bent or broken crystals that have been recemented are of common occurrence. The same crystals often enclose calcite, and others again have cavaties extending the whole length of the crystal, are entirely empty, or contain a rounded pebble of cleavable calcite.

I should like to engage your attention for a few moments on the occurrence of this mineral in Hull and Wakefield. At an opening known as the "Gow Mine," in Hull, a pit has been sunk 150 feet in limestone, parallel to the wall of a large fissure which may be said to characterize this band for several miles, it being made the more conspicuous by the abundance of crystals everywhere adorning its walls.

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Several mines have been established on this band with gratifying results. The apatite, which is mostly of the greenish variety, runs in most cases conformably with the limestone, although some small veins were seen intersecting it. The aggregate yield of this band in the township of Hull may be roughly placed at 4,500 tons.

We also find this mineral an ingredient of the orthoclase band running through this township, and like the latter, characterized in places by a contact wall covered with crystals of pyroxene, apatite, phlogopite, &c. I am not aware of any remunerative mines situated on this band. Many attempts have been made to work the small veins that occur at places, but have generally resulted in failure.

At Haldane's Mine, in Wakefield, a pit has been sunk 125 feet, on what appears to be a vein, cutting the stratification, of a dark-green granular apatite, impregnated with pyrites, also often enclosing epidote, scapolite, pyroxene, &c. The latter mineral is frequently of a cavernous nature, in which case the cavities are filled with chabazite and a silky fibrous mineral resembling natrolite.

At Wilson's mine in the same township a fine granular, strongly coherent, reddish apatite, mixed with a green, cleavable variety filled a vein 12 inches wide in gneiss, which, however, became "nipped" at no considerable depth.

In following some of the crystal beds at "Moore's Mines" large cavernous "*bugs*" were struck, walled with beautiful crystals of pyroxene, phlogopite and apatite. One of these caves was 30 feet long, 6 feet in width and 8 feet in height, roofed with a pink crystalline limestone, studded with green crystals of apatite standing out in relief on its partly dissolved surfaces.

The following statistics for the three townships may be summarized as follows:—For the township of Hull, up to the present time, between 5,000 and 6,000 tons have been extracted. Wakefield has probably afforded between 8,000 and 9,000 tons, and Templeton between 16,000 and 17,000 tons. The total output of all the mines in Canada for this year (1884) is 22,143 tons, extracting 1,790 tons supplied by the Perth and Kingston district, we have 20,353 tons, the product of the Ottawa county for one year.

We now come to the anhydrous and hydrated silicates, of which we have about 30 representative minerals.

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The first of these we shall notice is the fibro-tabular Wollastonite, occurring on lot 7, range 1 of Wakefield, in small delicate pink crystals, but which, however, soon fade on exposure. This mineral also occurs in large, fibrous masses in a dark sky-blue calcite at the same locality. A similar mineral occurs on lot 14 of the same range, enclosing an amber-colored garnet and prisms of a brown or greenish idocrase.

Pyroxene.—This mineral, either massive or crystallized, may be regarded as the most common associate of the apatite deposits. Now, under this heading, we have a number of varieties, but until more extended research shall have established their authenticity it will be better to retain the general name of pyroxene. The massive variety, which is mostly of some shade of green or grey, comprises large areas of rock masses, which may conform to the general deposition or cut it.

No attempt can or will be made, with our limited space, to enumerate every physical character offered by this mineral. But we will select such illustrations as may offer the widest points of difference.

On lot 9, range 13, of Hull, crystals of a grayish or grass green color, often doubly terminated, occur in a band of pink limestone, making up one-half its volume. They vary in size from 1 oz. to many pounds in weight. Good crystals are often found in the soil, that have been liberated by solution. The largest and finest crystals of this mineral are found at Moore's Mines, in Wakefield. Their planes, however, are rough and dulled by an incipient decomposition, a defect more than counterbalanced by their sharpness of angles. These crystals frequently attain an enormous size, often enclosing portions of calcite, phlogopite and apatite, and like the latter mineral are often found bent, and sometimes broken and recemented. On the 7th lot of the first range various modified forms of the four-sided prism occur in a crystalline limestone, and by extended replacements of their basal edges produce such forms as the octahedron with rhombic bases. Other complications exist, such as the enlargement of one set of faces at the expense of others, giving rise to very unsymmetrical shapes. Their color is white and translucent, their opacity depending on the advancement of decomposition that so conspicuously in places mars their exterior lustre. On this same lot a mineral is found, having the crystalographic form of pyroxene, exhibiting every hardness between 6 and

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2. In the vicinity of some lenticular patches of a serpentinous mineral fine inclined square prisms of pyroxene are associated with a scaly white garnet, and although their external planes are converted into an unctuous steatitic mineral their internal fracture are vitreous; generally semi-transparent to translucent, of a greenish white color. These crystals are built up of thin laminæ, parallel with their lateral planes, in the direction of which they cleave with great facility. The dark green lamellar variety occurs in patches in a massive scapolitic rock on lot 7, range 7, of Templeton, and at the same locality in calcite veins, crystals with rounded angles, often semi-translucent, are frequently met with. Fine crystals of a black color are said by Dr. Harrington to occur on lot 13, range 11 of Templeton.

The mineral uralite, also mentioned by the same gentleman, is found in many places in Templeton, where it apparently forms a transitory mineral between pyroxene and hornblende.

Hornblende, although a common associate of the apatite veins, is nevertheless never as constant as the latter mineral (pyroxene). Independent of the extensive rock masses wherein this mineral forms a variable ingredient, it may be said to be confined to mixed veins, commingling with such minerals as apatite, pyrite, pyroxene, epidote, scapolite, &c. The crystallised varieties are seldom observed in the apatite veins, although remarkably fine prisms often occur in close connection. On lot 12, range 16 of Hull, dark green translucent prisms nearly 4 inches in length are interspersed through a band of pink limestone. They are also met with in radiating groups in cavities in a pyroxene rock. A pale green translucent variety, occurs in modified rhombic prisms on lot 17, range 1 of Wakefield. A greenish gray fibro-bladed variety in reticulating masses occurs at one of the openings at Gemmill's mine in the same township, associated with apatite and occasionally enclosing ferruginous prisms of zircon. A broken section of the latter mineral measured half an inch by a quarter. The fibrous variety actinolite may be frequently met with. On the 12th lot in the 12th range of Templeton, a bluish, fibrous, partly altered hornblende occurs on the walls of an apatite vein.

A white fibrous tremolite is found in the neighborhood of Old Chelsea, in white crystalline dolomite.

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Garnet.—This mineral, until within the last two or three years, was regarded as a rare occurrence in this neighbourhood, being principally confined to small crystals, distributed through the laurentian gneisses. In the vicinity of the Baldwin Mines in Hull, the precious variety, probably almandine of a blood-red color, in lamellar masses, often an inch or more across, occurs in a schistose rock. A massive variety of a dingy reddish-brown color occurs on lot 18, range 2, of Wakefield, in a vein cutting the stratification. Crystals showing rhombic faces sometimes an inch or more across, are associated with crystals of epidote and stilbite in the more cavernous portions of the vein. The above garnet was mined to the extent of about two tons, in supposition that it was apatite. A red variety of this mineral occurs—according to Dr. Harrington—on lot 12, range 12, of Templeton. An amber-colored garnet, probably essonite, occurs on lot 14, range 1, of Wakefield. This locality a few years ago afforded some handsome crystals, having been extracted for apatite. A certain gentleman on hearing of the occurrence, with an eye to dollars and cents rather than national development, obtained, either by gift or purchase, nearly all the output. I am told some of these crystals measured three inches across, all of which were sold in the States. This locality has since been visited by dealers from Philadelphia and New York, who have now almost exhausted the mineral. These crystals occur in a bed of wollastonite, with brown prisms of idocrase; sometimes the latter mineral is imbedded in the former. Occasionally patches of a translucent scapolite are entirely enveloped in a coating of garnet. Notwithstanding its high lustre and bright color, it could not be applied to any ornamental use, owing to the grains constituting the crystals, being so loosely coherent.

A few miles west of this locality, on lot 6, in the same range, handsome crystals of a lime garnet, occur in a band of crystalline limestone, associated with pyrite, galena, sphalerite, wollastonite and pyroxene, forms exhibiting the faces of the rhombic dodecahedron and trapezahedron being common. Layers of the latter are often extended almost to the obliteration of the former. Their color varies from white, or almost colorless, to dark-green, passing through wine-yellow, sulphur-yellow, and purple. One perfect crystal from this locality would

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weigh about one pound, being of a dark-green color, translucent only on the edges. One of its planes was penetrated by an octahedron of grey pyroxene. The white variety attains even a much larger size, and crystals as large as a cricket-ball may be frequently met with. On the next lot, 7, a garnet apparently containing much more iron, fusing to a black glass, occurs in a band of disintegrating limestone, and, like the latter rock, is rapidly losing its cohesive properties. A portion of a large crystal obtained near the surface could not have weighed less than five pounds originally. Its color is more of a brownish tinge, and it is seldom as bright in lustre. A peculiar white scaly variety in crystalline masses, more or less mixed with a serpentinous mineral (its line of contact being often difficult to discern) occurs in close connection with the above. It sometimes exhibits one or more rough faces, which are invariably altered to a steatitic mineral.

Chrome Garnet.—Beautiful little dodecahedrons of this mineral occur in small groups, or attached crystals, in a fine granular grey pyroxene, on lot 29, in the 4th range of the same township.

Zircon.—Fine specimens of this mineral have been found at various times during the development of the apatite deposits in the above townships. A crystal 15 inches in length is said to have been found by a miner on lot 23, range 13, of Templeton, who, being doubtful of its nature, broke it up to satisfy his inward curiosity. You may imagine the poor man's feelings when he was told that he had just let slip through his fingers $200. One crystal preserved from this locality, now in the possession of Mr. J. G. Miller, measures four and a half inches laterally and one inch across the faces. Another crystal from Gemmill's Mine in Wakefield is said to be six inches in length. Small crystals may frequently be found in calcareous portions of the pyroxene rocks. On lot 14, range 1, of Wakefield, crystals from a quarter to an inch in length occur in a thin layer of shaly limestone that is intercalated between beds of wollastonite. At Haldane's Mine, in the same township, minute pink semi-transparent prisms occur in pyroxene.

Idocrase.—Handsome crystals of this mineral are found in Templeton and wakefield. Brownish-red slightly modified prisms, an inch in diameter, occur on lot 7, range 12, of the former township, and on lot 14, range 1, of Wakefield, brownish and greenish prisms often over an inch in diameter, occur in a wollastonite rock.

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Caxoclasite.—In this connection may be mentioned a mineral that has been described by Prof. Lewis, of the Academy of Natural Sciences, Philadelphia, as caxoclasite. This mineral occurs in blue calcite on lot 7, range 1, of Wakefield, in square prisms with their solid angles unsymetrically truncated. Its color is white, generally more or less stained with oxide of iron, lustre resinous, sometimes inclining to pearly, opaque.

The name chosen would imply that the mineral in question has a poor cleavage, whereas it has none. Then again, in the analysis given by the same gentleman, two or three per cent. of phosphoric acid was determined. Perhaps Mr. Lewis did not observe the minute prisms of green apatite that sometimes penetrate this mineral, and from which source, no doubt, his phosphoric acid was obtained.

Scapolite.—This mineral may be regarded as one of the most constant associates of the apatite deposits, generally occurring in bedded masses, sometimes alternating with hornblende, producing a banded structure of several feet in thickness.

At times masses of this mineral are made up of aggregations of huge but rough crystals of a grayish white color. However, some good examples of crystallized forms are met with in many places in Wakefield and Templeton. For localities in the latter township I would refer to Dr. Harrington's report, 1877-78. He says the finest crystals occur on lot 14, range 12, and on lot 23, range 13; crystals over one foot in length, although externally rough, are frequently met with. On lot 7, range 7, of the same township, a thick bed of grayish white scapolite was penetrated, enclosing patches of a lamellar dark green pyroxene and green apatite. On lot 10, range 10, a beautiful translucent variety occurs, and which assumes a pink color on exposure. In the township of Wakefield, on lot 17, range 1, fine square prisms, sometimes modified, of a grayish white color, occur, coating an outcrop of the massive variety. On the next lot, 18, range 2, a grayish translucent massive variety is interstratified with hornblende. On lot 7, range 1, doubly terminated prisms with rough exterior planes are liberated from a disintegrating limestone. On lot 6, range 2, a translucent canary yellow cleavable variety occurs, but how associated I did not ascertain.

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Wilsonite.—This mineral is now generally believed to be an altered scapolite, and may often be observed forming a neucleus in masses of the latter mineral. Good illustrations occur at many of the scapolite localities.

Epidote.—Independent of the occurrence of this mineral in the stratified rocks of the neighborhood, we meet with it in crystals lining cavities, besides forming an ingredient in many mixed veins. On lot 18, range 2, of Wakefield, dark yellowish green crystals, from a sixteenth to an inch in length, line cavities in massive garnet. At Haldane's mine in Wakefield large quantities of a greenish crystalline epidote were extracted, associated with pyrite, &c. Occasionally terminated square prisms of a light yellowish green color, enclosing disseminated pyrites, are embedded in a grayish green granular apatite, and are apparently pseudomorphs after scapolite. In the township of Templeton this mineral occurs on lot 9, range 10 and lot 23, range 13.

Mica.—This name will be retained to include a number of doubtful minerals, all of which have one perfect basal cleavage. Besides being disseminated through the schistose and gneissic rocks it often constitutes large volumes in some of the phosphate veins, either distributed in small scales through extensive masses of apatite and pyroxene, or forming large aggregations, sometimes affording plates two feet square in a calcareous gangue.

The mica fever, so prevalent in all parts of the Dominion, does not seem any milder in this neighborhood. The unwavering enthusiasm after marketable mica, encouraged by flattering reports, of irresponsible persons, will always remain a source of dubious speculation with the far-seeing capitalists. We shall not attempt to deny that unlimited quantities of this mineral are found in the above townships, but with one or two exceptions I have rarely met with plates sufficiently transparent, or free from included minerals, or from contortion, as to be available for commercial purposes. On the south half of lot 10, range 10, of Templeton, plates two feet square were taken out during the development of an apatite deposit. These plates were perfectly free from folds or inclusions, transparent enough in thin laminæ, but yet unsaleable because they would not stand the so-called New York fire test. Yet this same mica has been exposed to the heat of an ordinary

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stove for the last two years, and although it became slightly discolored it nevertheless compares favorably with some grades of the commercial article. At Chitty's mine in Wakefield, great quantities of this mineral were met with, capable of supplying very large plates, although occasionally marred by lateral joints.

What this mineral lacks in a commercial point of view is more than counterbalanced by the magnificent prisms available to the scientific world. For symmetry of form the crystals lining the walls of fissures, or enclosed in limestone, are not rivalled in the Dominion.

At Moore's mine, in Wakefield, prisms over a foot in diameter with lateral planes varying from an inch to a foot or more, stand out in relief on the dissolved surfaces of the limestone. Thin plates of this mineral are remarkable for showing in a strong degree the asterism or radiating star when viewed through a transparent plate of it. This is due, according to G. Rose, to intersecting minute crystals of biotite, but considered by Tschermak to be some undetermined substance. More recent investigations have put forth rutile as the inclusion. This peculiarity does not extend to all our micas alike, as non-asteriated varieties are frequently associated with the asteriated. Neither is it confined to any particular color, as the pearly white and the black both exhibit these optical characters. Prisms of the black variety often exhibit lateral cleavages, which are easily obtained, breaking up into rhombic forms. On lot 7, range 1, in the same township, a pearly white sometimes tinged with a copper red color occurs in a bed of limestone often holding concretionary inclusions of calcite. These crystals, which are sometimes twinned, are peculiarly characterized by a phosphorescent light that glows momentarily when the plates are suddenly parted. Large aggregates of these crystals are sometimes met with, where one-half the prisms, laterally, are transformed in a slightly micaceous steatitic rock, the unaltered portion having thin films of carbonate of lime interpolated between the laminæ.

Oligoclase.—A mineral occuring in veins in a gray pyroxene rock on lot 16, range 12, of Hull, has been referred by Mr. Hoffmann to oligoclase. It is often beautifully crystallized, of a slightly translucent white color, weathering to an opaque milky white.

Albite.—This mineral is mentioned by Dr. Harrington as occurring at several places in Templeton. No locality being cited, it is

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possible this name may be applied to many of our local feldspars, but until analysis shall have established their properties it will be better to refer to them under the general heading of feldspar.

Orthoclase.—The gneissic and granitic rocks, so extensively developed in these townships, consist for the most part of various colored feldspars, associated with quartz, mica, hornblende, &c. The strong structural resemblance of the various members of the feldspar family makes it difficult to discriminate between the several allied minerals. Neither do I think it possible (except in well crystallized specimens) to establish any member of this family without the assistance of the chemist or the microscope. I have no doubt that much of our feldspar belongs to the triclinic group, yet there is every reason to suppose the greatest bulk of the above bands is largely composed of the oblique potash variety (orthoclase). In the township of Hull large cleavable masses of a white, vitreous feldspar, enclosing a nucleus of a grey material, make up considerable proportions of one of the above bands, sometimes to the exclusions of the quartz altogether. Feldspar, in some form, is almost invariably present, in more or less quantity, in all the apatite veins, sometimes associated with homblende, pyroxene, quartz, sphene, &c.

Fine crystals of orthoclase are said to occur in Wakefield. In the township of Hull on lot 7, range 12, beautiful flesh-red crystals occur in cavities in a massive variety, and on the south half of lot 6, in the same range, large cleavable masses of a green feldspar, associated with a yellowish banded variety and a white translucent quartz, make up large proportions of a band traversing this lot. Sometimes large, brittle, black crystals of tourmaline are interspersed through this pegmatite rock.

Titanite or Sphene.—This mineral may also be regarded as a common associate of the apatite veins. Sometimes occurring massive in lenticular patches in pyroxene rocks, at other times distribnted in crystals through various vein-stones.

Rude crystals of a brownish color occur in many places in the township of Templeton. In Hull, lot 12, range 13, imperfect crystals of this mineral are so abundantly distributed through a pyroxene rock as to make up one-half its bulk. The finest crystals I have observed

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in these townships, occur on lot 7, range 1, of Wakefield, in a band of limestone. They are clove brown in color, sometimes measuring two inches across. A little south of this locality, on the same lot, crystals of a light cinnamon brown color are profusely disseminated through a dark cleavable pyroxene. The latter rock is cut by quartz also thickly studded with these crystals. A few hundred yards north-east from the latter place lenticular patches of a crystalline titanite of a dark brownish black color are enclosed in pyroxene.

This mineral is also said, by Mr. Frank Adams, to occur in crystals in a disintegrating dyke in Hull.

Tourmaline.—This mineral, of a black color, may frequently be met with, either enclosed by or investing the rocks of the neighborhood. Black, lustrous crystals, variously modified, occur in a pinkish calcite at Wilson's mine, in Wakefield, and in apatite on the next lot 17, range 1. Large radiating and reticulating masses invest the surfaces of a syenite, on lot 18, range 2. The interstices formed by the crossing of the prisms are occasionally filled with crystals of white scapolite.

The finest crystals of this mineral observed in this neighborhood occur sparingly on lot 15, range 12, of Hull, investing a hard grey pyroxenite. They are generally less than an inch in length, exceedingly bright in lustre. Their form is hexagonal, capped with planes of the rhombohedron. This mineral has been observed at several places in Templeton.

Having now reached the end of the anhydrous silicates, I will briefly allude to hydrous compounds.

Talc.—A mineral having the aspect of talc, occurs in small foliated masses of a silky lustre, enclosing a nucleus of calcite at McLaurin's mine in Templeton.

Steatite.—A mineral of the nature of steatite has been observed in several places in the above townships, forming small bedded masses. One of these is on lot 7, range 12, of Hull. On lot 7, range 1, of Wakefield, crystals of a yellowish steatite (pseudomorphs after pyroxene) occur in a coarse disintegrating crystalline limestone.

Serpentine.—This mineral is more confined to the limestone bands, through which it is distributed in grains, bands and lenticular masses.

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Its color varies from a light yellow to a dark green, often revealing a sharp conchoidal fracture. In the neighborhood of Chelsea, serpentine limestone is interstratified with other bands enclosing apatite crystals. In the same limestone bands of a semi-fibrous yellow variety occur, resembling the structure of hornblende, and possibly pseudomorph after that mineral. On lot 7, range 1, of Wakefield, large lenticular masses of a translucent green serpentine occur in limestone. It breaks with a sharp conchoidal fracture, and is occasionally marred as an ornamental stone by inclusions of a foliated graphite and large masses of a white micaceous-looking garnet.

Chrysotile, or Serpentine Asbestos.—This mineral occurs in the neighborhood of Chelsea, forming concentric veins in a serpentinous limestone. The fibres are sometimes an inch and a half in length, and rather too strongly coherent, I think, to be of any immediate commercial value. Other localities in the neighborhood of Templeton have afforded a similar mineral, the fibres, however, in this instance being more separable. A quantity was mined some years ago from one of the latter localities, but with what success I am unaware.

Ripidolite.—A greenish foliated mineral occurring on the west half of lot 18, range 9, of Templeton, is referred by Dr. Harrington to this variety.

Prehnite.—This mineral was noticed at Post's mine in Templeton, in greyish white, strongly coherent, mammillated groups; in cavities in pyroxene. It has also been noticed elsewhere in the same township.

Zeolite group.—Four representatives of this family have been noticed in the above townships, viz., stilbite, chabazite, natrolite and heulandite. The first mineral, stilbite, occurs in small, sheaf like aggregations of a yellowish or white color, associated with epidote, lining cavities in a massive garnet rock on lot 18, range 2, of Wakefield. A mineral in acicular tufts resembling natrolite is also often associated.

The mineral chabazite occurs at Haldane's Mine, in the same township, in transparent to translucent rhombohedral crystals, often a quarter of an inch across. Their color varies from colorless to wine-yellow, and frequently fine illustrations of penetration twins may be observed. I also noticed a similar mineral at Post's Mine, in Templeton.

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Heulandite.—This mineral, in small, opaque, white, oblique rhombic prisms, invests the surfaces of a paroxenic rock on lot 7, range 1, of Wakefield.

We now come to the sulphates, of which we have but one representative, in the form of Barite, or sulphate of barytes. This mineral is used extensively for the adulteration of white-lead, which, by affording a white powder when ground, together with its high specific gravity and cheapness, is often made to replace 75 per cent. of the lead, and although the bulk may be increased, the body of the paint is impaired.

A vein of this mineral, often veined with green fluor, was worked some years ago in the township of Hull. Another deposit of this mineral is on lot 12, range 12, of Templeton. It occurs in white lamellar bedded masses in gneiss. The appearance or overlying portion is more or less colored by the oxidation of some furruginous mineral, and is greatly mixed with calcite.

Carbonates.—Of this group, like the sulphates, we have but one member in the form of limestone, or calcite, Independent of the extensive beds of amorphous and crystalline limestone that so characterize this neighborhood, more especially the western portion, we find bands of a more cleavable nature cutting through the pyroxenic strata, forming the gangue of apatite and other minerals.

On lot 7, range 1, of Wakefield, a beautiful dark-blue cleavable variety is associated with wollastonite, and on the same property a translucent, green, cleavable variety, often exhibiting large cleavage planes, enclose garnet and pyroxene. Numerous other localities in these townships have afforded forms of the dog-tooth spar and other combinations.

Flourids.—Fluorite, or fluor-spar, may frequently be noticed amongst the associated minerals of the apatite veins. On lot 13, range 13, of Hull, small semi-transparent greenish cubes occur in a limestone, and on lot 10, range 14, octahedrons of the same color have been found. It is also frequently met with in small quantities of a blue, violet or purple color.

Anhydrous Oxides.—Independent of those members of this group already mentioned under iron ores, we have spinel and rutile to notice. The former occurs in cubes, sometimes more than an inch

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across, in a band of limestone, on lot 7, range 1, of Wakefield. These crystals vary from a dark-green to a light lavender blue, and may be more rarely observed in semi-transparent crystals of a pink color, constituting the spinel ruby. These crystals are built up of granular conchoidal fragments, which are often transparent. Some of these cubes when broken are found to contain a nucleus of a black, vitreous color, having the hardness of about four, and easily fusible before the blow-pipe. Another instance of the alteration of this mineral was observed in the same region where a group of these crystals were partly converted into a steatitic mineral. Crystals of spinel from the size of a pea to that of a bean are distributed through a grey pyroxene rock that extends over many acres.

Rutile.—Is found in small red geniculated crystals in barite on lot 12, range 12, of Templeton.

Silicon Group—Quartz.—This mineral, not only forms one of the commonest constituents of our rock masses, but fills many of the veins that traverse them. It sometimes encloses such minerals as apatite, pyroxene, titanite, &c. A vein of this nature occurs on lot 18, range 2, of Wakefield. Crystals of this mineral are by no means common; however, a few good forms have been met with in Templeton and Hull, of such shades of color as smoky-brown or amethystine, and colorless.

Jasper.—This mineral occurs in a bed 2 feet in thickness, overlain by gneiss, on lot 15, range 10, of Hull. It varies in color from a dark-red to a chocolate-brown, sometimes mottled with yellow, and is susceptible of receiving a high polish, comparing favourably with similar specimens from Lake Superior and Nova Scotia.

It is occasionally marred by inclusions of hard foliated masses of mica and crystalline specular iron.

Agate.—A yellowish-brown chalcedony alternating with bands of quartz may be referred to this mineral, occurring on lot 17, range 9, of Templeton.

Mr. W. L. Scott asked what Mr. Willimott's opinion was respecting the nature of caxoclasite, whether he agreed with Mr. Lewis as to its composition; also why the barite shaft on the road to King's mountain, which had been visited *en passant* on one of the club excursions had been abandoned?

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The lecturer had never visited the locality of the barite shaft, and could not say why it had been abandoned. He did not agree with Prof. Lewis in thinking that caxoclasite contained phosphoric acid.

Mr. LAWSON had not caught the lecturer's idea respecting the rounding of the angles of pyroxene and apatite crystals. He combatted the theory of igneous action and favored that of solution, Mr. Lawson considered the objections to the igneous theory satifactory, and did not think the lecturer had made out his case against the theory of solution, which appeared to be, that, as rounded crystals of pyroxene were found with similarly rounded crystals of apatite, the modification in each being evidently due to the same cause, and as pyroxene was totally insoluble, the rounding could not have been effected by a solvent. Mr. Lawson thought that water at very high temperatures could dissolve almost anything.

Mr. W. P. ANDERSON understood that the mica of this locality was phlogopite, which contained a small quantity of water, and was in consequence less refractory than muscovite, the chief commercial variety. He had been informed that muscovite was found in the Mattawa district, and wished to know if such were the case. The lecturer had no doubt of it, as he had specimens probably referable to that variety.

In reply to Mr. Small, the lecturer stated that his apatite statistics were derived from the export returns, and consequently were exclusive of the quantity mined and awaiting shipment, as well as of the 800 tons used in the Brockville Chemical Works.

Mr. LAWSON asked what the New York fire test for mica was? Mr. Willimott was not certain, but thought it was merely resistance to a blow-pipe flame. It was recognized as the standard of value in Canada. Muscovite was untouched by the blow-pipe flame.

In a discussion on apatite it was elicited that nothing less than 70% material paid, although arrangements were reported as being in progress for shipping 65% stuff to England for treatment by a new process. Members of the British Association had informed Prof. Macoun that the refuse of the Templeton mines was superior to anything worked in England, and that in the future middlings would be of great value.

Mr. LAWSON stated that untreated apatite was proving in the long run superior to superphosphate.

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Mr. WILLIMOTT thought this probable because in its action it would resemble the valuable fertilizer ground bones.

In reply to Mr. Fletcher, who asked if there was any official statement on the point, Mr. Small cited the report of the Department of Agriculture on tests made at the Agricultural College, Guelph, showing that good effects followed its use in the third year after application when applied to root crops, but not to cereals. He found this opinion endorsed in leading Scotch agricultural papers, and stated there was a large demand for the ground, untreated apatite in Belgium to fertilize the sugar beet farms.

Mr. FLETCHER thought if this were true the farms in the apatite district should be particularly fertile, which, from what he had seen in this district, did not appear to be the case.

Rev. Mr. MARSAN instanced some particularly fertile patches on the upper Gatineau, which had been worked for thirty years without manuring and still remained fertile. This success he attributed to the vicinity of phosphate deposits. He thought the two theories as to the best means of using the phosphate reconcilable. Roots require little phosphate, while fruits must have it. In spring it is found that all the phosphorus in a plant is contained in the root, in July it is in the straw, while at harvest time it has found its way into the fruit; consequently cereals would require it in such a form as would favor rapid assimilation, while root crops could get it from the more slowly disintegrating ground apatite. In the reports of the French agricultural schools preference was given to the raw material, and the French newspapers were advising the same treatment.

The lecturer's remarks on all points he considered most exact. He (Father Marsan) had studied the neighborhood of the Desert, which was very similar to the formation at Chelsea. No tract is so uniform as the crystalline limestone band. The observations of the survey had extended 60 miles up the Gatineau; 90 miles farther up the river the same formation was found.

He had found gold on Trout Creek, which empties into Eagle River. Although the geological formation would lead one to expect its existence he had paid little attention to the first reports of its presence, because farmers often confused mica and pyrites with the precious

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metal, and would show him finds of these glittering deceivers, but when he had an opportunity he brought a sample of sand to the College laboratory and found traces of gold in it; he had, however, been unable to obtain any sand since in consequence of the water being too high whenever he passed.

Respecting the apatite deposits he had reached the conclusion that they diminished in number and quantity as the Ottawa basin was left behind.

Prof. MACOUN said that from a botanical point of view there were advantages peculiar to each method of applying apatite, as annuals required phosphorous supplied rapidly and would benefit from superphosphate, while biennials would require it principally the second year as a constituent of their large crops of fruit.

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OBSERVATIONS ON THE TERRESTRIAL MOLLUSCA OF OTTAWA AND VICINITY.

F. R. LATCHFORD, B.A.

(Read February 5th, 1885.)

In a paper read before this Club on the 5th of March, 1880, Mr. G. C. Heron notes the occurrence in the vicinity of Ottawa of thirty-three species of terrestrial mollusks. While his list is remarkable not only as the record of a single year's work, but as the most extensive Canadian list previously published, it does not include many species which are now known to occur here. Some of these have been recorded from time to time in the reports of the conchological branch of the Club, and quite a number of others have been found for the first time during the past year. Owing to the importance of several of these additions, it has been thought advisable that a new list should be published, and the task of preparing it has been allotted to me. Recognizing that its value will depend wholly on its accuracy, I have been careful to include in it no species of whose identity I am not certain, and of whose occurrence here I am not personally aware. With a single exception, I have myself found every species mentioned. Chiefly for the benefit of members of the Club who may take up the study of this department of natural history, the localities in which the different shells now occur are pointed out, and such outlines of the form of certain species given as may, it is hoped, obviate the necessity of reference to publications not always readily accessible. In this connection, I would recommend as a most valuable work, Morse's Terrestrial Pulmonifera of Maine, a copy of which has been presented to the Club by the learned author.

In nomenclature I have often been at a loss what course to take. Following in the main Dr. Binney, I have in some instances adopted in preference, certain subgeneric names of Prof. Morse, which have not so far been generally accepted, but less on account of their propriety than because the shells to which they have been applied, being comparatively new to science and limited in their distribution, are very little known. As our shells in many cases do not agree in

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size with the dimensions given for the same species in the monographs of the Smithsonian Institution and in other publications, accurate measurements are given of every species.

Macrocyclis concava, Say.—In 1883 I found this species in considerable abundance in a thicket of prickly ash, in an open space in the woods on the left shore of the Rideau, above Billings' Bridge. Elsewhere it does not occur in abundance, though two or three shells are not unfrequently found together in several localities. The shells found under the prickly ash were burrowing in a strong clay soil. Their preference for this situation may be owing to the fact that the moisture condensed by the leafy shrub would be as abundant as in the woods, and remain nearer the surface than where the mould was deep, while it would be as little or even less subject to rapid evaporation. *M. concava* is noted for its cannibalistic propensities, and a specimen kept with smaller species destroyed several before its operations were observed. Our shell is almost transparent and measures no more than 14·5 by 12·3 mm. in diameter. Shells of this species received from the distinguished field conchologist, Mrs. Andrews, of Knoxville, Tenn., are 22 by 18 mm. and though "living" shells, are white and opaque like the "dead" shells found here.

Zonites inornatus, Say.—This species was probably once common on the Ontario side near this city, but so far as I know is not found there now. On the Quebec side it is not rare. High up on the westerly slope of King's Mountain, I found ten or twelve examples on the occasion of the Club's excursion thither on May 22nd, 1884. My favorite collecting ground, and the only one apart from the Laurentides, where this species is at all common, is near Fairy Lake. If you follow in a northerly direction the ridge of the hill beyond the Aylmer Road toll gate, a scramble of a mile over rocks and through tangled woods will bring you to a small brook, so hidden beneath rank growths of moss and fern that but for its musical fall of a few feet into a pebbly basin its presence would be unnoticed. The vegetable mould in the vicinity is deep, loose and moist, and in it numerous species find a congenial home. I have taken in this locality, in the space of a few yards, all the large helices found near Ottawa, and many of the smaller ones. The animal of *Z. inornatus* is bold and very active, and is colored various shades of blue. Mature shells have an average greater diameter of 13 mm.

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Hyalina nitida, Müller.—This is one of a number of species found here which occur also in Europe, but which are indigenous to America, and not imported. In low-lying places it is not uncommon. The woods near Billings' Bridge afford it in considerable numbers under logs and driftwood lying along the outlet of Dow's swamp. In July 1883, it was particularly abundant in company with *Succinea ovalis* on the verge of the brook flowing through the beaver meadow in Hull but both were absent on every occasion on which I visited the place during the past season. Owing to the moist nature of its habitat, it is able to venture abroad in the day time, and I have more than once observed it on warm, sunny days moving about actively early in the afternoon. In common with species which occupy localities subject to inundation, it is capable of living some time under water. Specimens kept forty-eight hours in an inverted test tube, immersed in an aquarium and containing no free air, were apparently lifeless when taken out, but soon recovered If placed unconfined in the aquarium, they find their way to the sides and climb to the surface of the water as quickly as possible. *H. nitida* is the largest of our *hyalinæ*, measuring often 7 mm. in diameter by 4·3 mm. in height.

Hyalina arborea, Say.—This occurs in hardwood groves everywhere, and sometimes in the driest stations in open fields. Indifference to its surroundings leads it to frequent even pine woods, which other species always avoid. It often burrows to a considerable depth in the under side of rotting logs. A few of the shells found here have a greater diameter of 5·6 mm., but the average of twenty specimens is only 5·1 mm.

Hyalina viridula, Menke.—Like *H. nitida*, this shell has a wide distribution in Europe as well as in America. It manifests like that species, but not to the same extent, a preference for moist localities, and is almost as common as *H. arborea*. It may be found near the city on the left shore of the Rideau canal, immediately below the Bank street bridge. It greatly resembles *H. arborea*, but may be readily distinguished from that species, when viewed from above by the sudden enlargement and comparatively greater width of the body whorl. It is also smaller by a little than *H. arborea*, seldom attaining more than 5 mm. in greater diameter, and has one whorl less.

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Hyalina indentata, Say.—This species is very rare here. I have taken occasional specimens in Billings' bush on this side of the Ottawa, but it is least rare in Hull, where it occurs with *Z. inornatus.* The shell is highly polished and transparent, and the lines radiating from the minute umbilicus distinguish it from allied species. The largest specimen taken measures 4·8 by 4·5 mm. Those usually met with are only a little smaller.

Hyalina binneyana, Morse.—In a letter to Mr. Fletcher, Mr. Heron stated that he had found this shell shortly before leaving Ottawa. It has not, however, appeared in the Club lists, nor in any list of Canadian shells. In looking over shells collected in Billings' bush I found several specimens which I thought at first were immature *H. viridula,* though remarking their difference in color. A careful examination of these shells and a comparison with typical specimens from Maine, kindly furnished by Mr. T. H. Aldrich, of Birmingham, Ala., prove them to be *H. binneyana.* It is pellucid and polished like *H. indentata,* but has an open umbilicus. Greater diameter 3·5, lesser 3, height 1·4 mm.

Pseudohyalina minuscula, Binney.—This was recorded from Eardley, Quebec, in the report of the conchological branch, published in Transactions No. 3 of this Club. I have since taken only two shells, but have no note of the locality where they were obtained. It seems very rare. The shells found have a greater diameter of 2·6 mm.

Pseudohyalina exigua, Stimpson.—In moss collected in Dow's swamp by Mr. Harrington in the fall of 1883, this species was found in considerable numbers. I have met with it in Billings' bush under bark and decaying leaves, and in similar situations in the hills northward. Many of our smaller shells appear to great advantage under the microscope, but in the delicacy and intricacy of its sculptured surface this is perhaps the most beautiful of all. It is very minute, its greater diameter being only 2 mm.

Striatura milium, Morse.—Mr. Heron records this shell in a foot note to his paper, and he informs me that he found it in Billings' Bush. I have searched for it there during several years and obtained only three specimens. In the moss from Dow's Swamp two others were found. It must be regarded as very rare in this vicinity. Under the

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microscope it yields in beauty not even to *P. exigua*. It is even smaller than that minute species, the greater diameter of my largest specimen being only 1·2 mm.

Striatura ferrea, Morse.—The only specimen I have found was obtained in the hills near the iron mines in Hull on the 16th November, 1884, when several other interesting discoveries were made. It is a very distinct species; but to be absolutely certain of its identity, I sent the shell to Prof. Morse, to whom I am under many obligations, and he returned it as correctly determined. Like *S. milium* it has only three volutions, but is less transparent and of a dead steel-grey color. The specimen found measures 2·8 mm. in greater diameter.

Conulus fulvus, Drap.—This little shell is very common in moist stations in shady woods, and sometimes in open pastures, often occurring in company with *H. viridula*. It is more globose than any helix found here except *Strobila labyrinthica*, from which it differs externally in being highly polished. It is subject to great variation in size, the greater diameter ranging from 2·4 to 3·2 mm. and the height from 1·3 to 2·8 mm. Jeffreys states that in England specimens collected in dry situations are much larger than those found in wet moss, but my largest shells were taken in a very wet station north of Fairy Lake.

Gastrodonta multidentata, Binney.—From a notice of the first excursion of the Club to the King's Mountain, published in a city newspaper, it appears that Mr. Heron found this shell there on May 22nd, 1880. It seems a very rare species. Repeated and careful search for it was unsuccessful until my visit to the hills north of Hull in November last, when I obtained one specimen under a log in a moist, well-shaded locality. It is 2·7 mm. in greater diameter.

Patula alternata, Say.—This is the only ornamented species of land snail indigenous to Eastern North America, *H. varians*, and the banded variety of *H. hortensis*, being importations from the West Indies and Europe respectively. It is the commonest of our large species, frequenting the open more than others, though often found in the woods, and seems capable of enduring the driest situations. In the fall it assembles in particularly large numbers, but is at all times more or less gregarious. In April, 1882, I observed hundreds under flat rocks near the old lime kilns in Rochesterville. The marl beds east of

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Hemlock Lake furnish it in great abundance. In the spring the animal secretes copiously a brownish fluid which stains the fingers, and which probably is the matter used to color the brown parts of the shell. In captivity it is not given to rambling, and if supplied with food will remain for days in the same place. The eggs are deposited in June and July, and measure 2·5 by 2·1 mm. I first noticed the young early in August, when they measured 2·6 mm. in greater diameter. They increased to 3·8 before hibernating in October. They had then and for the following summer a well-marked keel at the upper third of the last whorl. Mature shells measure 18·5 mm. in greater diameter by 16 mm. in lesser diameter, and have an average height of 10 mm. They are subject to considerable variation in elevation and depression and in the greater or less distinctness of the alternating color marks.

Patula striatella, Anth.—This is closely related to the last species in form, structure and habits, but appears to evince a greater love for the woods. The under side of a rotting hardwood log is its favorite resort, and in such stations in Billings' bush and elsewhere I have taken it in great numbers in late autumn and early spring, and, in less abundance, during the summer. It is usually light-brown in color, but is sometimes of a reddish tinge. Young shells, as in the case of *P. alternata*, are prominently keeled, and some specimens retain this peculiarity to maturity. The average greater diameter is 5 mm., but some specimens found measure 6·5 mm.

Planogyra asteriscus, Morse.—Mr. Harrington found this shell in moss gathered in Dow's swamp in 1883, and it was recorded from Ottawa for the first time in Transactions No. 5 of the Club. I find it also among shells collected in Eardley in 1881. It does not appear to be uncommon in moss in moist, well-shaded localities. Although less than two millimetres in greater diameter (its exact measurement is 1·8) it is easily distinguishable from other minute species by the numerous thin laminæ projecting at short intervals from the body whorl and giving the shell the appearance of an asterisk, after which it is very appropriately named.

Helicodiscus lineatus, Say.—This beautiful little shell is not uncommon in rich woods under moss and fallen trees, but does not occur anywhere in great numbers. Billings' bush or Dow's swamp may be

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depended upon to furnish a dozen specimens any summer afternoon. The animal is long and slender, of a whitish color and very timid. Greater diameter 3·3, height 1·4 mm.

Strobila labyrinthica, Say.—The normal form of this shell resembles *C. fulvus* in size and color, but its surface is strongly marked with raised lines of growth, and the aperture armed with six ribs, three of which are thickly set with sharp projections pointing outward. The yielding tissues of the animal pass over these without catching, but an intruding insect or other enemy would find his progress effectually barred by them. The color of the shells is generally brown, but I have found several examples which are of a chalky white. These albinos were taken living under troughs used in catching sap in a grove of sugar maples in Hull. A favorite station for this shell is in mossy crevices in rocks, where it is sometimes found in large numbers. From between ledges in Brigham's quarry I have taken it in great abundance. Greater diameter 2·4, height 2 mm.

Stenotrema monodon, Rackett.—This species, which was first described from Canada, belongs to a small group of distinctively American shells. It is common here in or near woods, and often in very dry stations, but nowhere do more than a few occur together. While it loves company it seems always satisfied with one or at most two companions. Its constant occurrence in twos and threes under the one log or stone is perhaps something more than a mere coincidence. It varies considerably in elevation and slightly in diameter. I have not found any whose greater diameter is less than 9 or more than 12 mm. The umbilicus in some specimens is wide and open, and in others from the same localities is so narrow as to be concealed by the reflection of the peristome. This latter form has been called var. *fraterna*, but it is not, I think, deserving of recognition even as a variety. On the other hand, the small, globose form termed var. *leaii*, which is never found here, though common in the Manitoulin Islands, seems to me clearly entitled to specific rank. The young of *S. monodon* have a simple lip, are brown in color, strongly keeled, and always covered with a velvety growth of hair-like projections. With age the lip thickens and becomes reflected, one tooth is formed on the labium and another within the aperture between the upper and lower walls of the last whorl. Lastly,

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the shell looses its keel and hirsute coat and becomes smooth and sometimes polished. The change thus produced between immature and mature shells is so great that it is at first difficult to realize that they are not altogether different species.

Mesodon albolabris, Say.—This our largest, and though not in point of numbers, our commonest land snail, is, on account of its size and color, the one most frequently noticed by an ordinary observer. Dead shells are often seen washed out by the rains from hillsides or lying in strong contrast with the blackened soil in the woods where fires have passed. Still, outside of a few localities I know of no place where an afternoon's diligent search would be rewarded with more than a dozen living and mature specimens. The marl beds east of Hemlock Lake can I find be always relied on to furnish this species in quantity. It would be hard to imagine conditions more favorable, the marl not only holding moisture well and producing grasses and mosses which, in growth or decay, afford rich supplies of food, but also furnishing in abundance, in what has once done duty for the same purpose, the very material required for the formation of shells. Another place where I found *M. albolabris* common in the summer of 1883, is a ravine in Hull, lying northward about a quarter of a mile from the house built and formerly occupied by Mr. Lindsay Russell. This locality, however, though visited often, afforded me very few shells during the past season, when my best find was made in an open pasture near the magnesian limestone quarries in Nepean.

M. albolabris varies in greater diameter from 20·5 mm. to 30·25 mm., representing in cubical capacity a ratio of 1 to 3¼. These are extremes, and though numerous examples approaching either limit may be found, the average size is nearer the maximum. The great majority vary between 24 and 28 mm., and fifty shells measured give a mean greater diameter of 26·2 mm. Very large or very small shells seem confined to no particular locality, but occur indifferently in all.

The shell of this species although sometimes of a light greenish color, is usually of a beautiful russet. The lip, broad and white in old specimens, is in the young comparatively narrow, and quite often of a delicate rosy tint, which unfortunately soon fades in the cabinet. The animal is generally of a pale grey color darkening towards the head.

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Of a number kept in my garden last summer I found the eggs of only one, which were in a cluster loosely adhering to one another and buried half an inch beneath the surface of the mould. They were thirty-eight in number and measured approximately 3 by 3·5 mm. In twelve days after their discovery (which was made on June 4th) some, and in fifteen days all, had left the eggs, and had well formed but very thin shells of somewhat less than one and a-half whorls. They had added nearly two whorls by the first week in October when, with their parents, they went into winter quarters, the old shells burying themselves in the mould and the young in moss, which had been kept as a preserve for minute species.

While neither this nor any other species found in this country serves as an article of human food—though *H. aspersa* is said to have been imported into California for that purpose, I know of an instance in which *M. albolabris* was used as a remedy for tubercular consumption, but not with the result desired.

Mesodon thyroides, Say.—This fine shell does not seem to occur in the immediate vicinity of Ottawa, but forty miles to the south-east, at Casselman, it was found in considerable numbers by Mr. Harrington on the 21st of August last. This is the first record of its occurrence in Central Canada, and I can find no evidence of its having been ever taken in Quebec. Near Toronto, Dr. Brodie informs me, it is not uncommon. It is a smaller and more elegantly formed shell than *M. albolabris*, and differs otherwise in having, like *M. sayii*, a narrow lip, an open umbilicus and a tooth on the parietal wall. A variety of *M. albolabris*, has also a toothed labium, but it does not occur here, nor even so far as I can learn, in Western Canada, though it might be expected there, as it is found in Michigan. *M. thyroides* is more elevated than *M. sayii*, and is larger than any of that species found here, the average greater diameter of the five examples I received from Mr. Harrington being 23·2 mm. It also differs from that shell in having a narrower umbilicus, and in wanting the tooth on the lower margin of the peristome.

Mesodon sayii, Binney.—Although generally considered a rare species, here in certain localities at least, it is not altogether uncommon. Unlike Mr. Heron, I have not been successful in finding it alive on the

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Ontario side of the Ottawa, though I have sometimes found dead shells. The nearest station to Ottawa where I have met with it is in Hull, on the northerly slopes of the hill beyond the Aylmer road toll-gate. A visit to this locality is usually rewarded with two or three mature living examples. Young shells are not nearly so rare. I took eleven in the afternoon of the 26th of April, 1884. They were from 13 to 16 mm. in diameter. Previously I used to leave immature shells of this, as of other species, where I found them, but having learned that helices were easily reared, determined to try the experiment with these young *M. sayii.* I placed them with mature shells of the same and other species in a glass-covered box, half filled with rich loose mould, moss and withered leaves well moistened; and kept them plentifully supplied with food in the form of lettuce, cabbage and flour paste, all of which they appeared to relish exceedingly. They grew rapidly, and by the 1st of July had begun to form a thick peristome. The tooth on the basal margin did not appear for some time. Still later the tooth on the parietal wall was formed, a thin transparent film at first, increasing in thickness and diminishing in length and breath as layer after layer was day by day deposited by the little artificer with as much precision as if the highest intelligence directed its operations. By September 1st, the shells were all fully formed, but quite thin. The addition made in captivity is lighter in color than the portion formed previously. It consists in no case of more than a whorl, but as this is the last and largest it increases the diameter of the shell more than a third and brings it to from 19 to 21·3 mm.

Whether from eggs deposited by these or the older specimens I cannot tell, but early in August I first noticed in the box a number of young shells a little more than two millimetres in diameter. They appeared to grow but slowly, yet by November had increased fully a whorl. On the 16th of that month, while collecting in the Laurentides, I found hibernating a dozen or more immature *M. sayii* precisely like those I had taken near the city the previous April. The lines of accretion formed immediately before hibernation were of a reddish colour. Between this dark band and apex, another band less prominent is distinguishable at the point reached in one season by the shells I had reared from the egg. From these facts I infer that *M. sayii* attains maturity in

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two years. *M. albolabris* appears to mature in the same period. In every specimen I find on the body whorls, about one whorl from the aperture, lines of growth thicker or darker than the rest, and about two and a half whorls from the apex a second and fainter series of dark lines. Besides these hibernation marks there are other irregularities less prominent, which indicate dry periods in summer, when the animal was obliged to remain inactive and growth was retarded. When the sign of hibernation in the body whorl is preceded, as it sometimes is, at a distance of four or five millimeters by a mark less distinct, it may be inferred that the autumn of the second year of the shell's life was cold and that the animal went early into winter quarters, but fine weather following, it came forth again and was able to grow a little before the cold came to stay.

Although the mesodons attain their full size in two years, the shell at the end of that time is quite thin. The occrrence of thick and thin shells in the same locality is due to the fact that some are old and others young.

Vallonia pulchella, Müller.—This is another of the helices found here which has a distribution both in America and Europe. It is also said, like *C. fulvus*, to inhabit Siberia and the Azores, and has accordingly not only a circumpolar range in three continents, but extends well to the south in a fourth. It is one of the smallest of helices, measuring only from 2 to 2·5 mm. in diameter. Although so small, its pearly whiteness renders it easily discernable, and it may be found in quantity almost anywhere here, under logs and stones near springs or the margins of streams. It manifests an especial preference for wet stations and is more common by far in open fields than in the woods. The animal is milk white in color, in part tinged with yellow, and is very timid. The slightest jar or movement made near by causes it to withdraw within its shell. The observer who places it on a slide and awaits its exit needs to be the possessor of great patience, but he will not be unrewarded for his pains though the little *habitant* refuses to come forth. The shell itself is a beautiful object under the microscope, and is sufficiently transparent to permit the beating of the animal's heart to be distinctly seen within it.

Puctum minutissimum, Lea.—This is one of the smallest land shells known, and if, as some think, identical with *P. pygmæum* of

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Europe, also one of the most widely distributed. West of Billings' bridge it is not rare, but on account of its extreme minuteness is very hard to find. I have also obtained it in Hull, but on either side of the Ottawa it occurs only in moist, but not wet, places, in hardwood groves. The greater diameter of the largest shell found here is 1·1 mm., height 0·6 mm.

Vitrina limpida, Gould.—Large numbers of this beautiful shell assemble together in the fall, and continuing together during the winter and for some time in the spring, then disperse. Late in October, 1881, it was particularly abundant under wet leaves and grass in the upper end of the Hull beaver meadow. As might be inferred from its northern range, it is very hardy, being excelled in this respect not even by the *limaces*. On November 16th, 1884, I noted great numbers in Brigham's pasture, Hull, under cedar logs in light, sandy loam. Although the ground was covered with snow and frozen for some distance on each side, under the logs the shells were all moving about among numerous clusters of eggs apparently not long deposited, and numbering from eight to twenty-three, in each cluster that I counted. The large clusters seemed too bulky to be the produce of a single individual, but as the eggs are not fully inflated when in the body of the animal they then require much less space than that which they occupy when deposited. The eggs, less opaque than those of the *helices*, and less transparent than those of the *limaces*, measure 1·4 by 1·1 mm. The shell itself has usually a greater diameter of 6 mm., but often reaches 7 mm. Shells from Hull much exceed in size those found on the Ontario side of the Ottawa. The whole internal economy of this species may be viewed through its transparent shell. The heart of one specimen was observed to beat 130 times a minute.

Limax agrestis, L.—The presence of this mollusk here could scarcely have passed unnoticed by Mr. Heron, who recorded many very rare species. For my own part, I did not find it until 1882, when I met with a single specimen within the city limits. In the same locality, in the following year and since, it has been very abundant. It is an imported species, its advent here, I am inclined to think, being quite recent. It is marvellously prolific: the eggs observed under a strip of board last October literally covered the ground. They are pellucid,

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nearly spherical, and 2·3 mm. in diameter. Leuch, a German, is quoted by Jeffreys as saying that a pair of these slugs have been known to lay 776 eggs. Some of them were dried eight times successively in a furnace and yet produced young. A number of this species placed in captivity early in November have been active all winter, although the storeroom in which I have kept them is often very cold, and their eggs have continued to be deposited apparently without intermission. As an instance of this hardiness of the mollusk, I may mention that one morning in January when the temperature of the room was 34° Far., or only two degrees above freezing point, I found a pair *in coitu* on the under surface of the glass cover of the box. On very cold days they remain contracted on the earth under a piece of basswood log, while the native species kept with them—*L. campestris*, under the same circumstances, cling to the log itself. *L. agrestis* attains a length of 55 mm. when fully extended, and is subject to great variation in color. Flesh tints prevail in the young, but in about fifty per cent. of the specimens observed they become in time replaced on the back and sides by dark blotches, more or less numerous, resulting sometimes in producing examples of a deep brown color. The rudimentary shell may be found beneath the posterior part of the mantle.

Limax campestris, Binney.—This is the species commonly met with in moist places in woods or open fields or along the banks of rivers—everywhere except on sandy soil. It is less than half the size of *L. agrestis*—27 mm. being about the average length—and is not so common in gardens as that species. I have found the two together only in one station, near McKay's Bay, New Edinburgh. At any period of their growth, even when of the same size, the two species are easily distinguishable by the usually lighter color, and greater opacity and apparent solidity of the foreigner. The foot of the native species also presents a more marked contrast between its centre and sides. While the mollusk is at rest the centre of the foot is bluish and semi-transparent, but when it begins to move, the muscles contracting form an opaque spot which advances towards the head and is quickly followed by another and another, presenting the appearance of a miniature torrent rushing with great rapidity from the posterior to the anterior end of the foot.

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If either *L. campestris* or *L. agrestis* is suspended in the aquarium on a sheet of glass or other convenient support, it will descend by means of a thread of mucus to the bottom, and making its way across it and up the sides, rests only when its breathing pore has been brought above the surface of the water. In its progress the tentacles are almost wholly withdrawn within the head, and vision, which must be dim at best, becomes impossible.

Tebennophorus carolinensis, Bosc.—This large slug is not uncommon in this vicinity inside the loosening bark of decaying trees and in rotting logs. On the Club's excursion last July to the Chats, it was observed in abundance in the woods near Mohr's wharf under the bark of old beech and elm stumps. It is very variable in color, some specimens being of a uniform yellowish tinge, others with dusky spots sprinkled over the mantle usually in groups of two or three longitudinal rows. My largest alcoholic specimen is 34 mm. in length, 18 in height and 12 in diameter. When extended it would be from 80 to 100 mm. long.

Ferussacia subcylindrica, L. (*Bulimus lubricus, Gould.*)—Mr. Heron states that this shell is found in great numbers six miles from Ottawa along the line of the St. L. & O. Ry. Near the city it is not, to my knowledge, so abundant, though still far from rare. I have found it most plentiful in a rocky field in New Edinburgh, lying beyond and to the left of the main entrance to Rideau Hall, and solitary specimens will be met with in the woods everywhere. The only two shells found in Hull on November 16th differ very much from those usually occurring. Measurements of what may be called the typical form give an average length of 6 mm., diameter 2·5. The Hull shells measure 6·8 by 2.3 mm. Although the diameter is only 0.2 mm. less, yet as the shells are longer than the type, they appear much more slender. It remains to be determined whether these two shells represent merely accidental variations or a fixed variety peculiar to the Laurentides. They were hibernating when found and had formed their winter epiphragm which is altogether different from the thin transparent membrane used during aestivation. It is thick, strong and calcareous, like that formed for winter use by *Helix pomatia* of Europe. None other of our indigenous shells, nor even those which are common to

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America and Europe, as *Hyalina nitida*, *Vallonia pulchella* or *Tachea hortensis*, form a calcareous epiphragm before hibernation, but I have observed a similar structure in *Aglaia fidelis* from British Columbia.

Pupa pentodon, *Say*.—In moss and around the roots of ferns and grasses this little shell may be found here rather abundant. I once took a large number in company with other pupas and many of the smaller helices, in the ravine at Upper Chelsea below the ruins of the old mill. It is smaller than any pupa found here, being only two mm. in length by one in diameter. The name *pentodon* is somewhat misleading, inasmuch as the shell has very frequently as many as nine teeth, though only five are prominent.

Pupa armifera, *Say*.—Although now added to our list for the first time, this species does not appear to be rare. My first specimens were taken in July, 1884, near the Hull abutment of the Pacific Railway bridge over the Ottawa. Previously, however, on the 6th October, 1882, five specimens had been found by Mr. Harrington on the cliffs above the Queen's Wharf in this city. It seems to manifest a preference for rocky situations. It is the largest pupa found here. If the measurements—$1\frac{2}{3}$ by $2\frac{2}{3}$ mm.—given by Binney and Bland in their monograph and repeated in Gould's Invetebrates of Massachusetts, are correct, this species does not here attain the size it reaches in the United States. Of the eighteen or twenty specimens taken at Hull the largest is only 4 mm. in length and the majority are only 3·6 mm. The disparity is still greater in diameter, which in our shells is not more in any case than 2 mm.

Pupa contracta, *Say*.—This is our commonest species. It occurs in moist situations under leaves and stones in woods and low pastures. One corner of the field on the opposite side of the railway from Dow's Swamp is very wet during the six months that the water remains in the canal near by. A number of cedar logs are in this corner, and under them *P. contracta* may be always obtained in abundance, accompanied by *Vallonia pulchella* and *Carychium exiguum*. All three are very minute shells, but owing to their color easy to find. This pupa is very much smaller than *armifera* and considerably larger than *pentodon* being 2·5 mm. in length by 1·3 in diameter. It has three and often four teeth, that on the transverse lip being very large and prominent.

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Pupa corticaria, Say.—In a letter to me Mr. Heron states that this shell is common in Billings' Bush under logs and bark and in moss at the foot of trees; but I have succeeded in finding only a few specimens. Several, however, were found in the moss collected in Dow's Swamp by Mr. Harrington. It resembles *pentodon*, but is longer and more slender and has only one or at most two teeth. The number and arrangement of the teeth render it quite easy to determine the identity of these small shells.

Vertigo gouldii, Binney.—The *vertigos* are still more minute than the *pupas*, but the chief difference between the two genera is in the structure of the animals. In *vertigo* the lower tentacles are wanting, while in *pupa* they are, though short, always present. *V. gouldii* is not rare. I have found it sparsely distributed in a number of localities and in abundance in one. This is on the left bank of Brigham's creek, at the head of the rapids, below Washburn's axe factory. An embankment has been constructed from the railway to the creek, and under and on the sides of the stones that lie on the grass near the shore this species is sometimes so common that I have collected thirty or forty there in the course of half an hour. On other occasions I have been unable to obtain more than two or three specimens. Unlike our *pupas* and like our other *vertigos*, one excepted, this species is of a brownish color. Binney (Gould's Invt., 2nd Ed., 440) gives the number of whorls as "rather more than four." One shell has fully five, but otherwise agrees with the type. Its length is 1·9 mm., diameter 1 mm.

Vertigo bollesiana, Morse.—Like *Striatura ferrea*, this rare shell is now recorded from Canada for the first time. The only specimen obtained I found in the hills near Ironsides. I took it for *pupa pentodon*, but perceiving differences with a lens, placed it under the microscope, when its identity with *V. bollesiana*, to my great joy, at once became apparent. Prof. Morse, to whom I sent it for examination, has returned it as this species. *V. bollesiana* resembles *V. gouldii* in the number and arrangement of the teeth, and *P. pentodon* in color. It has, however, only four whorls, and is smaller than even the former species. My specimen is 1·6 mm. in length and 1 mm. in diameter. The diameter given by Morse, $\frac{65}{1000}$ of an inch, is a little less.

Vertigo ovata, Say—Is our commonest species. In moss from Dow's swamp it was very abundant, and I have taken it in great num-

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bers under cedar logs in wet stations in the Hull beaver meadow. It has two teeth on the transverse lip, while the species above mentioned have only one. Compared with this, *V. bollesiana* is very small, and *V. gouldii* very slender. Its measurements are, length, 2 mm.; diameter, 1·2 mm. In Binney and Bland's monograph its size is given as much larger—3 mm. by 1·5, and in Gould's Invertebrates as slightly shorter and much less ventricose—"three-fortieths of an inch" by "one-twenty-fifth of an inch," or, expressed approximately in millimeters, 1·88 by 1.

Vertigo milium, Gould.—This species is still more minute than any yet referred to. It was first recorded from Canada in the report of the conchological branch of this Club in 1882, from a single specimen which I found in Billings' bush. I have since taken a few in the same locality, but none elsewhere. It seems to prefer the edges of bits of maple and elm bark. I have no doubt that it is not uncommon, but its extreme minuteness makes it hard to find. In fact it is by gathering pieces of bark and holding them up to the sun so as to catch the reflection of light on the polished shell that I have been able to procure specimens. Still it is not, at least here, as small as stated by the text writers. The length of the shells I have found is 1·1 mm., and the diameter 0·7 mm. In the description given in Binney and Bland its length is given as 0·8 mm.; diameter, 0·6. In all other respects our shell agrees with their description and the much better figures given in Morse and Gould.

Vertigo simplex, Gould.—Though larger, and therefore not so hard to find as *V. milium*, this shell is almost as rare. I have taken solitary specimens in Billings' bush, in Hull, and in a grove of young maples near Beechwood, but never met with a number at one time. It has more whorls than our other species, and the aperture differs also in being wholly unarmed with teeth. Here again my measurements differ from those I find given elsewhere. Mature shells of *V. simplex* found here attain, and sometimes slightly exceed a length, of 2 mm., while the diameter varies from 1 to 1·1 mm. According to the authors of the Smithsonian monograph its length is 1·6 mm., breadth 0·8 mm.

Succinea ovalis, Gould.—This, the most beautiful of our amber shells, is by far the commonest of the three species found here. It de-

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lights to live in the immediate vicinity of water, but it is not, as some think, amphibious. If placed in an aquarium it lies motionless on the bottom for a time and then tries to reach the sides of the glass and climb above the water. On old logs in wet places it is often very common. In Nepean Bay, just beyond the Union Station, a great many large pieces of boom timber were lying in 1883, and doubtless from many years previous; and on this timber, just above the water line, in July and August of that year I observed *S. ovalis* in countless thousands of every size. They were conspicuously absent from sticks of square timber cut the preceding winter, and on which the *algæ* on which they feed had not then begun to grow. This locality is now almost completely destroyed, having been filled in with refuse from the mills, and in 1884 afforded me neither this shell nor that which I chiefly sought there—*Sphærium truncatum, Linsley*,—a species I have not found elsewhere. The muddy banks of the brook in the Hull beaver meadow are the most prolific collecting ground for *S. ovalis* in this vicinity, and the shells found there are large and of a rich amber color. When collecting there in 1883, Mr. Harrington, who was beating for insects in alders along the brook, was surprised to find in his net a number of young shells of this species, which had climbed the alders to a height of ten feet.

On June 1st, 1884, I observed this shell in considerable numbers —many in *coitu*—on moss in a swamp near Sparks' Mills. They were slightly smaller than the Hull shells, which average 11·5 mm. in length by 6 mm. in diameter. Near the same place, but on the banks of the Ottawa I found later in the same year two remarkably large shells, which I refer to this species. The larger measures 17·6 by 8·5 mm, and the smaller 15·3 by 8 mm.

While camping with a few friends on an Island in Heath's Bay, County Pontiac, I saw *S. ovalis* appear in great numbers under very peculiar circumstances. One of our party, to whom had fallen in turn the tedious lot of taking care of the camp in the absence of his companions, found that fishing alone in the bay was wretched sport, and paddling his canoe near to the shore, began, in order to while away the time, to splash the water inland as far as he could with the paddle. To his infinite surprise and wonder the shore was soon covered with these

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living beads of amber, which moved slowly about, and as the stones became dry disappeared beneath them.

Succinea avara, Say.—This species is far from common here. Like *S. ovalis*, it inhabits moist places in the woods and open fields, but unlike that species, never congregates in large numbers. I have taken about a dozen examples in a space of five or six square yards in the locality which afforded me the very large *S. ovalis* just referred to. They are of much greater size than the shells usually found, averaging 8·5 by 5·6 mm. I have one shell still larger from Billings' Bush. It measures 10·4 by 6 mm.

There can scarcely be imagined a covering better adapted for protective purposes than that with which *S. avara* is provided. Overlapping the thin edge of the shell, the mantle secretes around the peristome a viscid substance to which particles of earth adhere and remain firmly attached. The shell closely resembles a speck of mud or fragment of bark; and as it is very slow in its movements, must often escape the searching eyes of enemies, whether bird or naturalist.

Succinea obliqua, Say.—This is the largest of the three species found here. It does not, like the others, frequent wet stations only, but is often met with in dry woods far removed from ponds and streams. It is quite a common shell, although not often seen except after warm showers in summer when they appear so suddenly and in such numbers that, like the young toads which sometimes accompany them, they might be thought to have fallen with the rain. The fact is that their dwellings being flooded they seek higher levels; and the wet ground being well suited for locomotion, make little expeditions on duty or pleasure until they find the earth becoming dry again, when they return to their hiding places in the grass or under stones They are unwilling to remain under water, but if confined there are, I find by experiment, able to live without free air for at least forty-eight hours. The largest shell found measures 18·5 by 10 mm., but the average is much less, being 14 by 8·5 mm. Shells a little smaller are very common in the marl beds, and specimens collected there hibernating on the 5th November, 1834, have since been subjected to cold far below the freezing point; and yet, if now placed in tepid water, they become active in a few minutes.

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The forty-two species above noted constitute the number of terrestrial mollusks now known to occur in this vicinity. That others may be expected will appear from comparison with lists of the shells found in the Eastern States, where the molluscan fauna is most like our own, and with the few imperfect Canadian lists which preceded Mr. Heron's. In 1864 Morse catalogued from Maine forty-nine species. *Vertigo bollesiana*, found subsequently, increased the number to fifty. With the exception of *Z. inornatus*, *H. nitida*, *P. armifera* and *Succinea obliqua* (which is replaced there by *S. totteniana*) all the shells found here are recorded from that State. Two of the Maine species, *Alexia myosotis* and *Melamphus bidentatus*, inhabit salt marshes and cannot be expected inland. The remainder, with the exception of *Mesodon dentiferus* and *Zoögenites harpa*, are European species introduced by commerce. One of these, *Tachea hortensis*, is said by Mr. Heron to have been taken near Ottawa. It is, however, with another species mentioned by Morse—*Pupa muscorum*—more usually a resident of the sea coast, though it extends inland along the St. Lawrence at least as far as Quebec. The occurrence of *Pomatia aspersa* in Maine and of the slugs *Arion ater* and *Limax flavus* is merely accidental, and none of these species appear to have obtained a foothold here. *Hyalina cellaria*, on the other hand, has increased rapidly and has extended far inland. Dr. Brodie found it in Toronto last September, and about the same time it was discovered in Portland, Oregon, by Mr. H. E. Dore. It is certainly a species that may be looked for here. As to *Z. harpa*, it appears to pass north of Ottawa, being found at Gaspé, James' Bay, and on the north shore of Lake Superior. *M. dentiferus*, one of the rarest American helices, can be traced to nearer home. It appears in Adams' "Shells of Vermont," a list including thirty-six species, and in a more accurate and extended list kindly furnished me by Mr. E. M. Goodwin, of Hartland, in that State. Mr. Whiteaves recorded it from St. Lambert, Que., in 1861, and it may be the shell catalogued from the valley of the Rouge as *Helix exoleta** by D'Urban in the same year. Dr. Brodie found it last summer in Muskoka. It accordingly occurs both east and west of us. The

*D'Urban's *H. exoleta* is more likely to be the toothed variety of *albolabris*, which, since the above was written, I found in the valley of the Lievres, in the County of Ottawa, near the High Rock phosphate mines.—F.R.L.

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hills along the right bank of the Gatineau, from Wright's Bridge to Gilmour's mills, presenting every variety of soil and hygrometric conditions, should furnish this shell if it is to be found here. *Pallifera dorsalis* is another species that we may soon add to our list.

In Adams' and Goodwin's catalogues appear three other species, which, though more southerly in their range than *M. dentiferus* and *P. dorsalis*, the presence of *M. thyroides* at Casselman leads me to hope will be found within the range of the club's operations. These are *Zonites fuliginosus*, *Triodopsis pallixta* and *T. tridentata*. All occur in the Adirondacs and at Toronto—*T. tridentata* coming east at least as far as Belleville.

There is a record of *Pupa fallax*, under the name of *Bulimus marginatus*, in D'Urban's list, and also of *Hyalina capsella* from Montreal, but these species I should not expect to find near Ottawa.

Not more than six possible additions to our list remain to be made. But a record of the occurrence of species, with remarks on their habits and relative abundance or scarcity, are only the first though necessary steps towards a satisfactory knowledge of our terrestrial mollusca. Their life history is still unwritten and opens up to the student a wide and fruitful field of observation.

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WHEAT, WITH SPECIAL REFERENCE TO THAT GROWN IN THE OTTAWA DISTRICT.

WILLIAM SCOTT.

(Read 19th February, 1885)

The wheat plant having been brought to us from other countries and not being (as far as we know) a native of America, it becomes necessary to speak of it first in a general way. It has not been found growing wild in any country, but is a plant of cultivation.

As an escape, it shows no persistency, and were its cultivation to cease, it would speedily die out and vanish from the earth. Its origin is still an unsolved problem. The grasses coming nearest to it are *Triticum repens* (the creeping couch grass) of Great Britain, and the *Ægilops ovata*, a grass found growing wild in southern Europe. This latter is accepted by some botanists as the parent of our cultivated wheat.

Grant Allen claims that wheat ranks by descent as a degenerate and degraded lily. That it was at first a simple plant, without flowers. After ages, it acquired those bright colours and beauty that rivalled "Solomon in all his glory." Then it fell from its high estate and became a rush, with dry, brownish flowers, then a wood-rush, and finally a grass, when it had to toil for a living, and begun storing up starch and gluten.

De Condelle says that the bulk of evidence goes to show that the home of the wheat plant is in the country lying between the Persian Gulf, the Mediterranean, Black and Caspian Seas.

We know that wheat has been cultivated as far back as there are records of man. The monuments of ancient Egypt, of an age previous to the Shepherd Kings, whose rule ended about 1600 B.C., and the ancient books of the Hebrews show that in those days it was already well established, and whenever the ancient Egyptians or Greeks allude to the introduction of wheat, they attribute it to some fabulous personage.

The lake dwellers of Switzerland cultivated a small variety of wheat, a specimen of which, dug up at Backs, shows this prehistoric variety to have been cultivated down to the time of the Roman Conquest.

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Another variety less common during the Stone age, has been found in Western Switzerland and Italy, and still another variety in Hungary, grown apparently during the same period. A grain of this type of wheat has been found in a brick belonging to the pyramid of Dashur, to which is ascribed the date 3359 B.C. None of these varieties are identical with any now grown.

The Chinese claim to have grown it 2700 B.C. It is said to have been introduced into America by a slave of Cortez, who found a few grains in some rice brought from Spain. It reached Massachusetts in 1602, Virginia in 1611, and the Mississippi valley about 1718.

Botanists classify the wheat plant in its various forms under the name Triticum vulgare. Some apply the name Triticum hybernum to the bearded, and Triticum pestivium to the beardless form, while others give these names to the winter and summer varieties, respectively.

A number of varieties, on account of their compact spikes, have been classified under the name of Triticum compactum. Other varieties with a long, loose, nodding spike and glumes long and bearded, are known by the name of Triticum polonicum. The stems of this plant have been known to grow to the length of six feet. Triticum durum, or horn wheat, is a flinty variety. It is cultivated extensively in the vicinity of the Mediterranean, and yields a good crop in a very poor soil. This variety is identical with the goose or rice wheat largely grown in Canada to-day, and is almost worthless as a flouring wheat.

Mummy wheat is called Triticum compositum, probably on account of the ears being composed of branches sometimes to the number of ten or twelve. A single ear of this wheat frequently contains as many as 150 grains, and as it naturally follows, the quality is very poor. It has been grown in Canada under the name of Egyptian wheat.

A variety closely resembling mummy wheat is known in England under the name of Clog wheat, a peculiarity of which is that the stem contains a light pith.

With reference to the wheat found in the tombs of Egypt there is no evidence to show that a single grain of it has ever sprouted.

The varieties of wheat are now practically countless, one French investigator having produced over 300. They differ in size, shape and in the physical character of the berry; some are long, some short; some

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have thick bran, and some thin; some are brown, red, amber or white; some are soft and starchy, others hard and flinty. Fall-wheat may be changed into spring-wheat and spring-wheat into fall-wheat by repeated sowing in about three (3) years.

A grain of wheat is not a seed but an entire fruit, and roughly speaking consists of three main elements: the husk or bran, the flour and the germ.

The husk or bran consists of four layers of cells, the two outside ones being called fruit coats, and the two inside ones being called seed coats. In the first layer the cells run lengthways along the berry and become shorter as they approach the ends. The cells of the second layer are across and round the berry. From the first of these layers, at the end opposite the germ, springs a mass of vegetable hairs forming what millers call the "fuzz," and which they remove as much as possible with scouring machines, before the wheat is ground.

In wheat the walls of these hairs are thicker than the width of the canal. In the fuzz of rye the canal is wider than the thickness of the wall. This furnishes one mode of detecting a mixture of rye in wheaten flour. Underneath the fruit coats we find the seed coats called the dermis or covering of the germ; the cells of these coats cross each other almost at right angles. The upper one is called the transparent layer and the lower one the color layer. It is the coloring matter in this layer that gives the peculiar hue to the wheat berry which we term red, brown, amber or white. The only exception to this is a variety called violet wheat found by the African traveller Hildebrand on the shores of the Red Sea, the coloring matter in this variety being found in the transverse cells of the outside coat.

The inside seed coats contain a peculiar kind of ferment which acts upon the gluten and liquefies it. This ferment is insoluble in water. Boiling water destroys its activity, a lower temperature retards its action, a dry heat of 212 degrees Farenheit does not effect it. Moisture and warmth are necessary for its development and a temperature of about 75 degrees Farenheit is most favorable.

Underneath these inside coats there is a thin film which botanists tell us is the remains of the seed bud.

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Situated in the end of the berry, opposite the fuzz end, is the germ with its shield furnished with small straight tubes through which it absorbs the fluid starch. The germ contains fatty matter and it is stated that one pound of oil can be extracted from 100 pounds of germ. The miller therefore carefully excludes from the flour, the bran with its ferment and the germ with its oil, for were these allowed to remain in the flour it would not keep but would spoil in a short time. This ferment in the bran is the cause of the miller's bran pile heating in warm weather.

Starch, which is more used by the human race than any other chemical compound, except water, and which is found in every plant that has been examined for it, constitutes about from 55 to 75 per cent. of the wheat berry.

Its granules consist of granulose encased in cellulose, which is a covering of the same chemical composition as granulose, but so dense as to render the starch granules insoluble in cold water. Treated with boiling water they swell and burst and the starch then becomes soluble.

Starches differ in the size and density of their granules, the largest being found in a kind of arrowroot called *Tous les mois*, next to this comes the potato, then sago, the bean, pea, wheat and maize. Although maize gives the largest percentage of starch, yet the potato surpasses any known product in the quantity produced from an acre. It is owing to the density of the starch granules in maize that bakers scald cornmeal with boiling water before mixing it with flour when making cornbread.

Starch submitted to a high temperature with some moisture forms dextrine or British gum which is used for stiffening goods, for sizing paper, and for adhesive purposes, and therefore when the tongue is applied to an envelope or postage stamp the only danger incurred is the absorption of a little modified starch. Egyptian wheats being poor in gluten and consequently of low value for bread-making are largely used in Great Britain in the manufacture of British gum.

Although starch occupies such a large portion of the wheat berry, yet (taking its nutritive value and the part it plays in the mechanical process of breadmaking) the gluten is by far the most important constituent.

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If a piece of dough is kneeded in water the starch will wash out and leave in the hand an elastic, sticky, grey or yellowish substance called crude gluten. As nitrogen is not found in starch but in the other constituents of the wheat berry, these are called the nitrogenous parts, and as the chemical composition is similar to animal albumen they are called the albuminoids—sometimes divided into soluble and insoluble albuminoids—under which latter name gluten (being a compound substance) is often designated. Some say that gluten is found throughout the wheat berry in sacs along with the starch granules. It was formerly supposed to be in one layer of cells next the bran and as it was thought impossible to remove the bran without taking some of this layer with it, the conclusion was jumped at that the best portion of the wheat was thus lost, and some people under this delusion still habitually or periodically rasp their digestive surfaces with indigestible branny foods.

It is on the quantity and quality of the gluten that the goodness of the wheat and consequently the quality of the flour depends, and as the percentage of gluten varies from about four (4) in poor wheats, to about thirty (30) in good hard wheats, there is ample room for the almost innumerable grades of flour.

Wheat with a small percentage of gluten is termed "soft" wheat, and wheat with a large percentage of elastic gluten is termed "hard" wheat.

Some varieties of wheat, notably red winter varieties, contain a large percentage of inferior gluten which millers and bakers term "short" in contradistinction to "long" gluten which is more elastic and which is characteristic of our Canadian fyfe wheat.

Wheat is sometimes injured in the harvest field by continuous wet weather. Heat and moisture start the ferment in the bran, the gluten begins to dissolve and the germ to sprout, and when the flour is made into dough, the chemical action continues, and the baker says the flour runs, the result being dark, heavy bread, caused by the gluten being too weak to retain the gas generated by the yeast or leaven.

Bakers counteract this chemical action with lime-water or alum, but as our climate is comparatively a dry one alum is seldom used in this country.

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The variety alone does not give us a high gluten value.

Soil, fertilizers and weather influence the grain favourably or unfavourably to a great degree. A high, dry temperature is also necessary during the ripening and harvesting periods. A fine looking sample of Oregon wheat, grown west of the Cascade Mountains, gave only 7 per cent. of gluten, owing to the excessive rainfall and damp climate of that portion of the country. For the same reason, and also because of a partially exhausted soil, the wheats of Great Britain are soft, some Scotch wheats giving only 5 per cent. of gluten. That the yield of wheat in Great Britain is about 30 bushels to the acre, may be accounted for not only by the use of fertilizers, but also by the product being soft, that is, having a small per centage of gluten. If in Great Britain it were possible to grow hard wheat, that is, wheat with a large percentage of gluten, the product per acre would be much smaller. Millers in Great Britain require to import hard wheat to mix with their soft wheat, in order to make strong flour.

Turning to Hungary, which may be termed the home of hard wheat, as it is the home of the new process of grinding it, called the Hungarian or roller process system, we find it described as a country of extraordinary fertility, in the form of a basin or plain at the foot of the Carpathian Mountains. The driest months are July and August. Soon after sunrise the temperature during these months rises to about 74 and in the course of the day attains to from 95 to 100, remaining at that until nearly sunset, while during this time there is little or no rain and the nights are dewless. This same characteristic of climate during the ripening period, belongs to the Vistula country of Poland and the famous black soil country of Southern Russia, although the winters there are much more severe than in Hungary. An analysis of Hungarian flour of different grades, gave from 35 to 42 of moist gluten. Hungarian wheat, sown in England or in Scotland, becomes soft; and English or Scotch wheat, sown in Hungary, becomes, to a certain extent, hard.

The macaroni and vermicelli of Italy consists of a dough made from hard wheat pressed into the shape of tubes. Italy, after having exhausted her own lands, has drawn on the hard wheat provinces of the South of France and the North of Spain, and also on the North of

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Africa, one African variety yielding as much as 26 per cent. of gluten. The manufacture of macaroni is now carried on in other countries, notably at Odessa, on the Black Sea, and also in New York.

When the riches of a virgin soil become exhausted a lower, though more enduring level, appears to be reached, which precedes its final exhaustion for wheat growing.

The product of this lower level is soft. This may be seen to day in old Canada and the United States, where fall wheat constitutes about three-fourths of the entire crop. Fall wheat contains a lower average of gluten than spring wheat, and therefore its cultivation has extended into the North-Western States, where it was formerly supposed that it could not be grown.

Returning to the Eastern Coast, we find that the New England States now grow wheat enough to last their population only about three weeks.

Clifford Richardson, in his report to the United States Department of Agriculture, shows that the wheat and flour of the Eastern States are low in albuminoids, and that the percentage gradually increases as you go westward, until the Rocky Mountains are reached, when it again declines to the Pacific Slope.

Minnesota, long known as a hard wheat State, is gradually turning into one of soft wheat, a large proportion of her crop last year being soft, and the millers of Minneapolis have accordingly drawn a large portion of their hard wheat from Dakota Territory. In a few years more they will, without doubt, be compelled to draw on our North-West country for their supplies of gluten. Dakota wheat contains about 25 per cent. of gluten and Manitoba wheat about the same or perhaps more.

Coming nearer home we find that the Province of Quebec is about exhausted for wheat growing, and that Ontario is now in process of exhaustion. A short review of the varieties of wheat grown in this vicinity may serve to bring this out more clearly, and I may say that although the quantity grown is limited, yet in no part of Canada, that I know of, are there more varieties of wheat grown than in the vicinity of Ottawa. Beginning with spring wheat, a variety called Black Sea, is about the oldest known here. It is a bearded wheat. The berry is

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small and of a dark-red color. The straw is fine and slender, so much so, that if the weather is wet during the ripening period, it is sure to lodge. A peculiarity of this variety is its tendency to shoot out or throw up a number of stocks. It was formerly extensively grown in the Province of Quebec and in this vicinity on both sides of the Ottawa, but is now grown only by a few farmers who have good soil, principally heavy clay. I am not aware that it has been grown in any other part of Canada. Its name suggests whence it came to us.

Fyfe, or as it is sometimes called Scotch wheat, is said by tradition to have taken its name from a man named Fyfe, who got some out of a cargo shipped from the Black Sea to Glasgow, and who brought it to Canada. Others say it came to us from Fyfeshire, in Scotland. However, there is little doubt that originally it was a Russian wheat. It corresponds very closely with a celebrated variety of Poland known as Sandomir wheat, as the Black Sea does with another called Szkalmirka, both being native wheats of the Vistula country of Russian Poland. Fyfe wheat is dark in color, so also are the native wheats of Hungary and Russia. Fyfe is a bald wheat, with strong straw and small berry; and as the bran is very thin, it consequently yields a high percentage of flour. It varies in color from light to dark-red. It is therefore called Red Fyfe, in contradistinction to White Fyfe, a very much inferior milling wheat, its only point of resemblance being the shape of the berry. It is hardly necessary to state that the Red Fyfe contains a larger percentage of gluten than any other known variety. I think the line of species might be drawn between the bearded Black Sea and this Fyfe wheat, and if they are not direct descendants of prehistoric wheat, they are at least not far removed from the parent stock.

Red Fyfe wheat spread from Old Canada to the Western States and thence to our North-West, the land of hard wheat. It is now fast dying out in Ontario, being grown only in spots where the land is new, or where the land, if old, is rich and deep. We have a few such spots in the vicinity of Ottawa, one notably in the township of Eardly, where, in a strip of land lying between the mountain and the river, this wheat has been grown for the past twenty years or more, and is still grown in all its purity.

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With regard to the other varieties grown here it is difficult to get their proper names, as some of them have different names in different localities. Thus "Lost Nation," which is also called "Parry Sound and McCarlem," is a variety somewhat resembling Fyfe, but with a larger, longer and coarser berry. It is an average milling wheat, containing from 12 to 15 per cent. of gluten. It may be seen in some of the North-West samples, where it passes for Fyfe wheat. One sample that I saw from Duluth was all pure "Lost Nation," and was graded as No. 1 hard Fyfe.

"Club" and "Golden Drop," two varieties resembling each other have small, short, light colored berries. They are grown principally in light soils, and average from 8 to 10 per cent. of gluten. "China' or "Rio Grande," having a large, coarse, wedge shaped, dark colored berry, ranks as a milling wheat about the same as "Club Wheat."

"Red Fern" has a small dark colored berry resembling Black Sea wheat, and its milling value is about the same. It is grown principally on heavy clay land, and contains from 10 to 15 per cent. of gluten.

"Red Chaff" (so called from the col ur of its glumes) is an utterly worthless wheat for milling purposes, and the berry so much resembles Fyfe wheat that only an expert can tell the difference.

Goose, Arnectka, Rice, or Garibaldi wheat, was known in this part of the country some twenty years ago under the name of "Midge Proof." It is a dense, light colored, almost transparent wheat, and ranks about the same as Red Chaff for milling purposes—that is, almost worthless.

From Fyfe we have descended through these and other varieties that have come and gone, each one with less gluten (or, as we say, softer) than its predecessor, until now we are down to a thick skinned, soft, starchy wheat, called White Russian. This variety (known in the United States under the name of "Lost Nation") constitutes, along with Goose wheat, the bulk of the spring wheat grown in Canada. Its percentage of gluten is very low, probably from 6 to 7 per cent., and consequently by itself it does not make a strong flour.

In the white fall wheats we have had the same degeneration. The Deihl, Soules and Treadwell, wheats rich in gluten, have vanished, and

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in their place we have thick skinned, soft starchy wheat, called Clawson.

Red and Amber, winter wheats introduced into Western Ontario some five or six years ago on lands not completely exhausted have given a satisfactory yield, producing good grades of flour with high percentage of short gluten. The strength of these varieties, however, is on the decline, and in a year or two more they will in all probability have run their course.

It has now become evident that a variety of wheat with a large percentage of gluten requires a new, rich, deep soil; also that a variety with a smaller percentage of gluten will yield a larger crop on the same soil; also that a partially exhausted soil which will not grow a wheat with a high percentage of gluten may give an abundant crop of a softer variety; also that the softer the variety of wheat the thicker is the husk or bran; consequently not only is the quality of the flour poor, but the quantity is also less. This gives rise to contention between millers and farmers, the former asking for quality, and the latter growing the variety of which his land will produce most.

Gilbert and Lawes say that season comes before fertilizers. This statement applies especially to Great Britain, where they seldom have a good season. The season of 1884 was probably the best, the world over, that this generation has seen. Wheat growing countries (Canada included) brought forth bountifully, and the present low prices are the direct result of the unusually large yield.

Yet with plenty of wheat, we have been importing flour from the United States at the rate of six or seven hundred thousand barrels per year, simply because the strength of our land is being exhausted and our wheat is soft or deficient in gluten. It has been repeatedly proved that the percentage of gluten can be increased by fertilizers, Prof. Mark in one instance increasing it 8 per cent. Clifford Richardson in his report says (alluding to Gilbert and Lawes' experiments): "This seems to show that the application of mineral manures to our Eastern lands should bring up the yield of grain and the quality as far as we are able to judge and profit by these experiments abroad.

Yet Canada is allowing thousands of tons of phosphate to leave her shores every year, which, if manufactured and spread over her ex-

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hausted fields, would in future years more than repay the temporary gain she is now getting from the sale of it.

Turning now to a country which in the marketing of its first million bushels of wheat may be said to have just passed its first birthday (our Canadian Northwest), we find a land whose extent and richness it is difficult to comprehend, and whose capabilities for wheat growing are as yet comparatively unknown.

It is only necessary to examine the samples of our North-west wheat to know that they are the product of a wonderfully rich soil.

It is true that, owing to the rush with which the country was opened up, and to the consequent difficulty in getting good seed (settlers being obliged to take whatever they could get), some of the samples are mixed, but the fact that some of these mixed samples have passed for hard wheat only further proves the capability of the soil, by its hardening soft wheat, that is, increasing its natural percentage of gluten.

Gilbert and Lawes, in a report of an analysis of the soil of the North-west, say: "These proved to be nearly twice as rich in nitrogen (or plant food) as the average of arable soils in Great Britain—probably about as rich as the average of the surface soils of English permanent pasture." And again: "All these soils showed an exceedingly high percentage of available plant food."

Prof. Macoun from botanical evidence maintains that the wheat fields of the future will be found further west on the now so called barren plains, and I may say that in comparing these lands with other hard wheat countries I, in a less scientific way, arrived at the same conclusion, yet this conclusion was arrived at before I had the pleasure of hearing Prof. Macoun express his decision. And further, taking the wheat growing plains at the foot of the mountain ranges in Europe, taking the State of California, a State in which some years ago the growing of wheat was thought impossible, but which last season led the States and Territories of the Union with a crop of over fifty million bushels, I feel sure that the great plains, now called grazing country, lying at the base of the Rocky Mountains, will in future years become an immense wheat field, capable of supplying not only the wants of Canada, but also a large portion of the wants of outside importing countries.

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The country importing the largest quantity of foreign wheat is Great Britain. In 1864 Russia supplied 41 per cent. of this quantity, and the United States 21 per cent. By 1874 the United States had taken Russia's place, and by 1884 Russia had been shoved aside by India, with Australia pushing hard for third place.

The United States' wheat crop for 1884 amounted to over five hundred millions of bushels, but it is not likely that it will ever again have so large a surplus for export. On the contrary, owing to the unprofitableness of wheat growing in the Middle and Southern States, the increase of population, and the gradual and inevitable exhaustion of the soil, there is every probability that the quantity exported will show a decrease each succeeding year.

Great Britain's colonies and dependencies are now rising from a position of dependence to one of support; and before another decade has passed away the country we call our home will, by the production of wheat in its great North-west, occupy the foremost place in that Greater Britain that is to be.

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NOTES ON OUR SAW-FLIES AND HORN-TAILS.

W. HAGUE HARRINGTON.

Read 4th March, 1885.

TENTHREDINIDÆ.—When asked by our Soirée Committee to prepare a short paper for this evening I furnished them with the above title, thinking that I would be able to prepare a list of our local Tenthredinidæ and Uroceridæ and to preface it with a few remarks on some of the genera and species. A more careful examination of the material in my collection convinces me that it would be injudicious to attempt the preparation of a list this year, and that by deferring it until after another season's collecting it may be very much more complete. It may then even be possible to publish one of all our Hymenopetra.

To show how incomplete our knowledge of the species still is I may mention that of seventy-two species of saw-flies which I have determined there are only fifteen in which both sexes are represented. Of the remaining fifty-seven there are forty-eight represented by females and nine by males. It will thus be seen that as regards the male insect only one-third of my species is complete. This scarcity of the males seems to hold throughout the order (hymenoptera). My remarks this evening will therefore be very brief, and confined to a few of the more important species.

Cimbex Americana, Leach.—This, our largest saw-fly, is not uncommon some seasons, the larvæ being frequently found on elms, although, not being gregarious like many species, they do no noticeable injury.

Trichiosoma triangularum, Kirby.—At first sight this might be mistaken for one of the varieties of the last-named species, but it is smaller, more hairy, and differs in several points of structure. I have only taken one male, but have found large green, cimbex like larvæ which were apparently those of this insect.

Abia Kennicotti, Nort.—Mr. Guignard has kindly given me specimens of this bee-like species, which were, I believe, taken by Mr. Fletcher last spring.

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Acordulecera dorsalis, Say.—This species is not uncommon upon the bitter hickory (*Carya amara*) in June and August. My specimens are all females of *var. b.* of Norton. Abbé Provancher has described, from a single specimen, *A. saginata*, which seems to me to be identical with this variety of *dorsalis.*

Hylotoma.—We have three species, all of which appear to be rare.

Cladius isomeria, Harris. The larvæ of this species are yellowish, black-spotted grubs, occurring plentifully on willows in June. They spin a light, transparent yellowish cocoon, and the flies emerge toward the end of July. Specimens bred by me last year were all females, and I am indebted to Mr. Fletcher for the male.

Nematus.—Of this destructive genus we have several species, including the universally known *ventricosus*, or currant saw-fly. Another species which has attracted much attention recently by its ravages on the larches in Quebec, New Brunswick and portions of the United States, has apparently reached this locality, and will be found here next summer, viz., *N. Erichsonii.*

Messa hyalina, Nort.—Mr. Guignard has captured a number of this species, which has not hitherto been recorded from Canada. He informs me that they were obtained in his yard in July, and had probably been carried thither by easterly winds from some large poplar trees on Waller street.

Emphytus.—Four or five species of this genus occur, including *E. maculatus*, a well-known foe to strawberry plants.

Dolerus.—Of our six species of this genus, *aprilis* is the most common, and is the only one which has yielded both sexes; *unicolor* and *arvensis* are probably sexual varieties of one species, as specimens of the former are all males and of the latter all females. My specimens of *arvensis* were obtained early in May upon stumps covered with fermenting sap, which attracts many insects.

Dinuera Americana, Prov.—I have captured one specimen of this rare species, which has the venation of the wings very irregular, the cross nervure between the marginal cells being almost obsolete, and there being only three sub-marginals instead of four.

Selandria.—This genus contains several very injurious species, of which *rubi*, the raspberry saw-fly, is perhaps the most obnoxious. Its

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larvæ were very abundant during the summer, both on cultivated and wild raspberries.

Allantus basilaris, Say.—A large saw-fly common on golden-rod in August. Larvæ unknown.

Macrophya.—Five species of these rather handsome saw-flies have been taken, chiefly upon alders, or the plants growing in their vicinity, but I have not succeeded in identifying the larvæ of any species.

Strongylogaster and *Taxonus* contain a number of species which it is somewhat difficult to distinguish satisfactorily, especially as the majority of my specimens are males.

Tenthredo.—This genus has furnished a dozen species, all of considerable size and variety of colouring. They are chiefly found in moist localities where there is a profusion of herbaceous plants; such a locality may be found in the beaver meadow near Hull.

Lophyrus.—A genus not hitherto included in Canadian lists. Abbé Provancher, in his admirable treatise on hymenoptera, states that he had never met with specimens. We have, however, at least three species occurring on evergreens. *L. abietis* is not rare on spruce, nor *L. Abbottii* on pine. *L. fulvus* is remarkable for having only 13-jointed antennæ, and was originally described from a specimen from Texas.

Lyda.—The species of this genus are very numerous in America, and are separated on very small differences of form and colouring, so that the determination of species is difficult. We have five species, generally found on pines, upon which the larvæ of one or more have been found feeding.

UROCERIDÆ.—There are but six species to record in this family, belonging to four genera, and only two of the six can be said to be numerous.

Oryssus occidentalis, Cress.—A male of this species (hitherto recorded from the Western States) was captured by Mr. Fletcher, and is now, through the kindness of Mr. Guignard, in my collection.

Uroceros albicornis, Harris.—These insects are sometimes found flying about our streets, having apparently emerged from telegraph poles. Last August males were observed on larches at Stewarton. One of these, when disturbed, flew off some distance in an angry or excited manner and returned to the precise spot on the small branch upon

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which he had been resting. This he repeated several times until captured, although no reason could be discovered for his attraction to the spot except a small wound in the bark from which a drop of resin exuded. These males I then supposed to be those of *U. flavicornis*, but further examination seems to prove them *albicornis*. In 1882, *U. cyaneus* was abundant in September and the beginning of October, during which period I captured ten females and five males. These were all taken about the city, and I was then of the opinion that they came from the maples, which are by far the commonest shade trees along our street. As the insects have since been rare it seems probable that they also came from the telegraph poles. Perhaps the large number of new poles that are at present being put up may furnish us with some interesting insects during the approaching season.

Tremex columba, Fabr.—This is by far the commonest of our Uroceridæ, and is also the largest. It attacks principally maple and beech which have been wounded, or which from old age have commenced to decay, but it also occasionally lives in other trees. It may be found in the autumn emerging from, or ovipositing in, the trees just mentioned, and the bodies of those which have perished in the latter act are frequently seen fastened to the trunks. The males are very rare.

Xiphydria albicornis, Harris.—In the summer of 1883 this species was very plentiful in the city and neighbouring woods, infesting young or medium sized maples, to which they are apparently very injurious, as they riddle the wood with holes similar to those of tremex, except that they are smaller. During the past season this insect was rare and only a few specimens were observed. *X. attenuata* is a very rare insect, of which only two males have yet been captured.

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TWO NEW SPECIES OF CRINOIDS.

WALTER R. BILLINGS.

(*Read 4th March, 1885.*)

GENUS EUSPIROCRINUS, ANGELIN.

EUSPIROCRINUS OBCONICUS, n.sp.

Cup obconical, about $\frac{1}{3}$ wider than high; tapering from 0·75 inch at top to 0·25 inch at the column.

Underbasals, five in number; pentagonal; subequal; about $\frac{1}{8}$ wider than high.

Basals, five; three hexagonal and two—those adjacent to the anals—heptagonal.

Radials, five; wider than high; subpentagonal; alternating with the basals; the middle third of their uppermost side slightly excavated for the attachment of the brachials.

Brachials, variable in number; of the anterior arm, four; left posterior arm, three; right anterior and right posterior, five; and the right anterior either three or four, I am unable to say which, the specimen not being sufficiently perfect. Above this the arms dichotomize frequently one branch after leaving the bracial dividing on the fourth plate, the divisions of which bifurcating on the fifth plate, and at least once again higher up. The secondary and tertiary bracials seem to vary from five to six, the quaternary to be five, the quinary eight.

No pinnulæ.

Anals three, within the calyx; the lowest one pentagonal having its two lower faces resting against the sloping sides of the posterior and the right posterior basals, the second resting on the upper side of the posterior basal, having on its right the first and third anals and on its left one of the radial plates. Above these is a ventral tube of large pieces of which but three series of three plates each were fully observed.

Column of a 5-foil section, with a canal of corresponding shape and a width about one-half that of column. The portion of column collected is three and one-half inches long; 0·25 wide at base of cup,

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tapering to 0·15 inch at 0·35 inch from base of cup, from whence downward no taper or expansion is visible. Joints of column about 0.25 inch thick, slightly gibbous in centre; each joint consisting of five pieces as in some species of *Heterocrinus*.

This species agrees with Angelin's genus *Euspirocrinus* in the arrangement of the cup-plates, anal area, ventral tube and arms. The brachial plates differ from those of the typical species in number, which is only a specific difference. The author of the genus considers, as also does Mr. C. Wachsmuth, that the coiling of the arms, such as is shown on plate 4, fig. 7*a* of Angelin's beautiful *Iconographia*, as characteristic and notable from a generic point of view; but as 7*a* of the same plate does not indicate this peculiarity, I look upon the failure of my specimens to show anything beyond a tendency (such as is to be seen in *Carabocrinus*) to curl inward as not affecting the generic relations of this species.

This species is the first described from American rocks. Belonging to a genus resembling *Poteriocrinus*, excepting in its lack of pinnulæ and differing from *Dendrocrinus* in its anal area, it is an interesting addition to our list.

TRENTON FORMATION.—One of the two specimens collected was obtained on Division Street, Rochesterville, and the other at Hull, P.Q., in the C.P.R. cutting adjacent to the Aylmer Road crossing. —Collector W. R. Billings.

GENUS ARCHÆOCRINUS.—WACHSMUTH & SPRINGER.

ARCHÆOCRINUS DESIDERATUS.—n.sp.

Cup subglobose; the breadth once and a-half the height.

Basals, once and a-half to nearly twice as long as wide; five in number; hexagonal; bent to an angle of 90° at about $\frac{2}{3}$ of their length from the column, the united basal plates forming for the first portion of their length a cone surrounding the column, and their distal sides supporting the primary radials.

Primary radials 3 × 5; the lowest series pentagonal; the second hexagonal; the third pentagonal, each supporting two rows of secondary radials four plates to each row. Each row of secondary radials supports two rows of tertiary radials having each two or three plates all of which are included within the cup. The quaternary series are free

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arm-plates, six rows to each ray, of which the inner rows of tertiary plates each support two and the outer one; so that there are thirty arms, which are robust and fringed with stout pinnulæ. The arm-pieces are first single and sub-cuneiform, but change gradually until about the fifth or sixth plate they consist of two rows of interlocking and alternating cuneiform plates.

In each interradial area the proximal series consists of one plate, resting directly on one of the basals, succeeded by two plates in four of the areas and three plates in the azygous; above which the plates are much smaller. As stated above, the radials are connected with the interradials, as high as the top of the tertiary radials, which is the base of the arms; at this point four or five of the last inter radial plates connecting with each tertiary radial form part of a flexible fold, which is continued onward four or five plates further into a cornu, the point of which approximates to that having its rise on the opposite side of the same interradius; these folds and cornua were, at first sight, supposed by me to be arms.

When Mr. Wachsmuth defined this genus the arms and the vault were unknown. The specimens figured show these features in a very satisfactory manner. The vault is seen to be composed of very small plates, and with an anal opening near the ambulacral centre. There is no proboscis and the vault and arms approximate to those of *Glyptocrinus*.

The cup-plates are smooth and gibbous. The radial plates have obtuse ridges, following the longitudinal axes of the rays, much elevated at the sutures but almost obsolete in the middle of the plates.

TRENTON FORMATION.—All the specimens collected by the author on Division street, Rochesterville.

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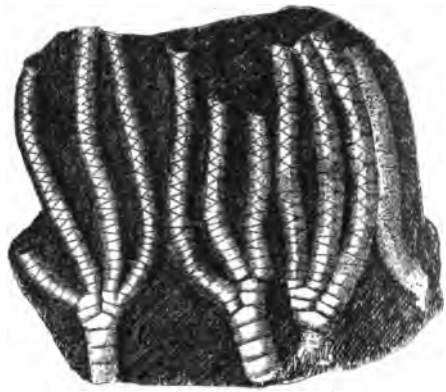
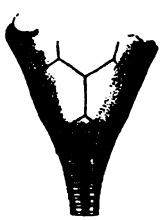
Archæocrinus desideratus *n. sp.*



A flattened specimen showing portions of arms, one of which has four tertiary radials—an abnormal number.

Posterior view of an almost perfect cup.



Specimen from Hull P.Q.

Euspirocrinus obconicus *n. sp.*

Specimen from Division Street, Ottawa

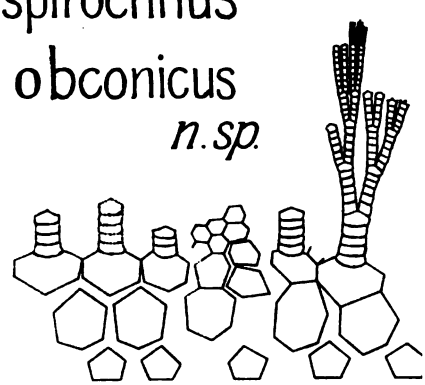


Diagram of Ottawa specⁿ

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B.B. ET W.R.B DELT. S.C. McLAUGHLIN. PHOTO-LITH.

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p.250 - pl. 2

Archæocrinus desideratus *n. sp.*

Basal view of an almost perfect cup.

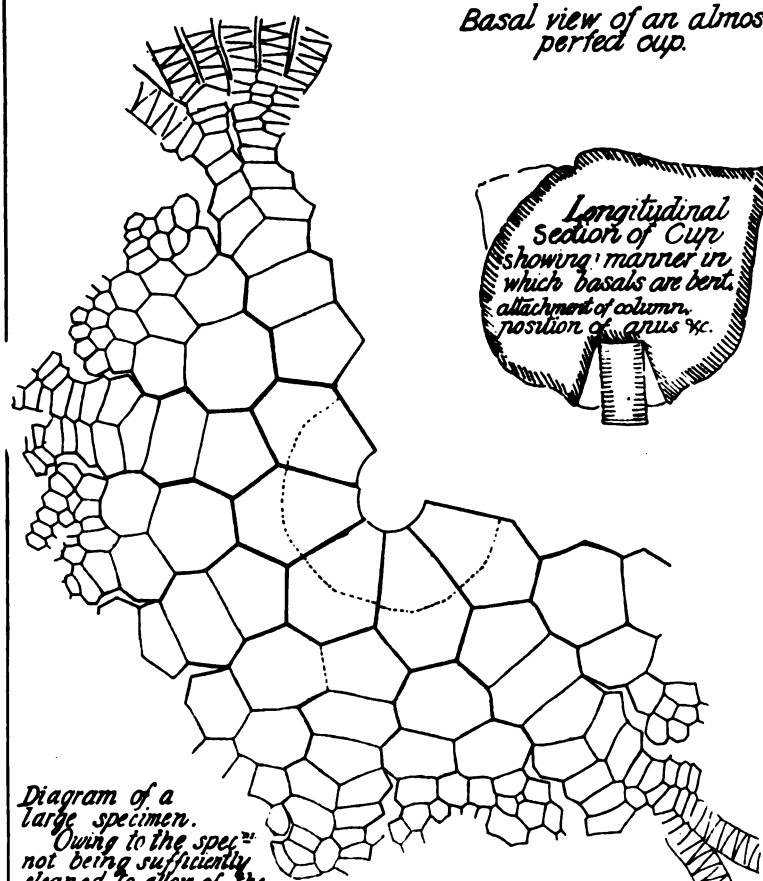

Diagram of a large specimen. Owing to the spec.ᵐ not being sufficiently cleaned to allow of the underbasals being seen, they are omitted here and in the description, although probably present.

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ADDITIONAL NOTES ON THE GEOLOGY AND PALÆONTOLOGY OF OTTAWA AND VICINITY.

BY HENRY M. AMI, B.A., ASST. PALÆONTOLOGIST GEOL. SURV. OF CANADA.

Read 4th March, 1885.

Further enquiry into the varied and interesting as well as extensive series of strata exhibited in the Ottawa valley, both above and below the city, has added not a little to the sum of our knowledge already recorded in the transactions of this society and elsewhere. Both in palæontology and stratigraphy, much new to the locality, to Canada, and in some instances to science, has been discovered.

The field of research is vast and important, but fortunately a decided increase in the interest taken in geological science has marked the season just closed. No less than sixteen members of the geological section took advantage of the sub-excursions, a number of whom made collections whilst others took only a partial yet appreciative interest in the subject.

The beautiful sequence of the fossiliferous sedimentary strata, ranging from the Upper Potsdam to the Hudson River inclusive, is here well defined and may be studied to great advantage not only from a mere chronological standpoint but also in comparison with rocks considered to be synchronous with these, and deposited under rather different conditions in other portions of this continent. To trace out accurately and ascertain the degree of submergence and elevation which at different times are known to have occurred in this neighbourhood during the palæozoic period; and likewise to note the sequence of life during this same period as evinced from the *palæontological data* already obtained and still coming in, the changes in the *flora* and *fauna* corresponding to the changes of water-level, are indeed tasks worthy of a Murchison, of a Sedgwick, a Barrande, a Logan, or a Billings. Without going into details as to the result of a number of sections which have been studied from exposures in this neighbourhood, the general results obtained in the field during the past summer may be summed up as follows, the notes on each formation being given separately.

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Potsdam Formation.—At Montebello, Mr. Louis J. Papineau has been carrying on extensive operations in this formation and has discovered numerous tracks of marine animals upon the sandstones which once formed an ancient sea-shore. Some beautiful slabs have been extracted.

Chazy Formation.—As has already been noticed in former transactions, the measures of this formation are clearly divisible into these series in the following ascending order: (*a*) *Sandstones*, with flags and shales; (*b*) *Shales*; (*c*) *Limestones*. The sandstones are very poor in fossils. Aylmer town and Pointe des Chenes, however, have yielded a few species, whilst a specimen of *Lingula*, as yet undetermined, but probably new, was found in the shaly division at Hemlock Lake, New Edinburgh; at Hog's Back, Nepean, some very fossiliferous beds occur, one especially noteworthy containing abundance of *Lingula Belli*, *(Billings)*, a Lamellibranchiate shell also undetermined and *Cyrtodonta breviuscula*, *(Billings.)* Numerous black phosphatic nodules, probably coprolites, are frequently associated with these.

On the occasion of the Club's visit to Moore's Landing, opposite Quyon, about 40 miles west of Ottawa, the *geological branch* had a splendid opportunity afforded them of examining a fine section of the Chazy formation. The measures at this place are exposed from the river margin to the top of the hill (with a few places of concealment) a thickness of 135 feet. This exposure can be traced down the Ottawa in an undoubted continuous series as far to the east as Skead's Mills, near Ottawa, along the Ontario shore, outcrops of which are almost everywhere to be seen, but especially about Berry's brewery and along the lake shore and at Brittania. This tract of country was geologically coloured as Calciferous in the 1866 map published by Sir Wm. Logan, but from conclusive palæontological evidence obtained at this excursion it can be positively asserted that these measures are of the Chazy formation. Deposited horizontally and even now quite undisturbed, the beds at Moore's Landing hold an abundance of organic remains in the uppermost or limestone portion of the section. The characteristic band of impure limestone teeming with remains of *Entomostraca* may also be seen here in its normal position—as at Aylmer, Hog's Back, L'Orignal, etc., from which places it has been recorded.

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The species most abundant is probably the *Leperditia Canadensis, var Louckiana* (Jones.)

The associated bed of limestone exhibiting numerous and large concentric patches of rock supposed to repesent the *Stromatocerium rugosum* of Hall, is exposed along the road a considerable distance, and fine specimens have been collected of what appears to be the above species. A doubt still exists in the mind of the writer as to whether or not this bed, which is almost if not entirely composed of this organism, may not be merely the result of concretionary action. Microscopic sections of specimens prepared by Mr. Weston have not given any characteristic structure. Besides the above there were collected: *Columnaria incerta* (Billings), a fossil coral; a *Pleurotomaria* like *P. pauper* (Bill.), an *Orthoceras sp.* and *Leperditiæ* already referred to. There is but little doubt that the strip of country lying between this place and Ottawa, now occupied by the Ottawa River, and extending some distance on either bank, presented at one time a perfectly flat and continuous aspect.

Denuding agencies have evidently been at work in forming the bed of the Ottawa River and also to a certain extent Lake Des Chênes —agencies which during the "glacial epoch" must have been much more active than the present slow but sure denuding action of subaerial or atmospheric erosion.

Another very typical exposure of the Chazy formation was observed and examined to the eastward of the Rideau Hall grounds close to where the measures of the Trenton formation, characterized by the abundance of fossils peculiar to that horizon, and considerably disturbed owing to a local fault, come in contact with it.

The characteristic bed of concretionary (?) or laminated limestone is well exposed over a considerable area in the country lying between Mr. Matheson's property and the Rideau Hall grounds, occupying the superior portion of the measures throughout the greater part. This area, as at present known, presents an irregular contour bounded on almost every side by faults and dislocations of purely local origin, bringing the measures of the Chazy in contact with those of the Black River, Trenton, and Utica (?) formations—showing how intricate and at the same time interesting the geology of Ottawa is.

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Besides affording good sandstone and limestone for building purposes and also flagstones for paving; the Chazy formation about Ottawa affords good hydraulic cement. On lot 34, Con. A, Nepean, Mr. C. B. Wright has opened a large quarry in three be ls lying close to one another in the uppermost part of this formation, and for years past has obtained a large quantity of a magnesian limestone having a marked conchoidal fracture and often containing small cavities lined with pink calcite crystals. Higher up the river and on the line of strike of the above mentioned exposure the same beds were noticed at several places, whilst in the "Geol. of Canada," 1863, page 806, it is stated that they are continuous from Allumette Island to Hawkesbury, a distance of over 100 miles. The cement, known commercially as the "Hull Cement" and manufactured by calcining this rock with an admixture of clay as the argillaceous constituent required in certain definite proportions, has been characterized as "a strong and lasting cement"—(see descriptive catalogue of the minerals of Canada—Dr. Selwyn, 1876.) The clays used belong to the post tertiary epoch and are of marine origin, being known as the "Leda Clays."

There has been a considerable demand for "Hull Cement" in foreign as well as home markets during the past year, upwards of 8,000 barrels of hydraulic cement having been shipped from this port whilst there have already been extracted 1,750 loads of cement-stone this winter for calcination during the coming season. The cement belongs to that class known as "slow-setting."

Bird's Eye and Black River Formation.—The measures of this formation about the Petite Chaudiere on the north and south shores of the Ottawa River were visited and a number of the characteristic species of fossils collected, e. g. : *Columnaria Halli*, (Nicholson), *Tetradium fibratum* (Safford), etc.

Notes were taken on the much faulted and disturbed strata at this locality which assumes its peculiar orographic aspect on account of faults cutting the measures in a parallel series of steps—whence the rapids.

It is very difficult to ascertain in many instances the exact amount of faulting, yet the exposures are most interesting and deserve close study.

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Proceeding eastward from the city we find another interesting exposure of this formation occurring at the branching of the road leading to Beechwood cemetery, close to the swamp. Here a very interesting section may be seen showing the contact of this formation with the Utica, indicating the presence of a local fault or dislocation apparently causing a downthrow on the west side of the fault of at least 200 feet. This fault is a remarkable one, and can be traced to a distance of two miles on the Ontario side, traversing the country in an approximate north and south direction, crossing the swamp above referred to, and may be seen bringing the measures of the Trenton at a high angle to the horizon on the east side of Mackay's Bay. The Black River formation here, as in other places about Ottawa, is characterised by beds of dark blue and grey impure limestone affording good building stone, almost throughout its whole measures. At this exposure the lower measures of the formation are tilted at an angle of 90° where they come in contact with the Utica formation, then proceeding eastward the beds are seen to dip at various angles to the east, the angle gradually decreasing until the summit of the bluff and the cemetery are reached, where they are practically horizontal, dipping but slightly to the east.

Amongst the organic remains found here may be mentioned *Tetradium fibratum* (Safford), *Helicotoma planulata* (Salter), *Pleurotomaria lapicida* (Salter), besides lamellibranchiata and bivalve entomostraca in great numbers requiring further study.

Trenton Formation.—In this tolerably well known and interesting formation some points of interest are always sure to come up, both as regards its palæontological record and local stratigraphical significance At Ottawa and vicinity the Trenton, like its closely related formations, is affected by a number of faults, and it has been pretty conclusively ascertained from flexures in the strata, accompanied by faults, exhibiting what is generally termed a monoclinal structure, or simply a "monocline"—that there has been in most instances a downthrow on the west side of the faults, which have a general north and south bearing at right angles to the course of the Ottawa River. The Trenton formation, as exposed at Nepean Point and old "Barrack," or now "Parliament Hill," presents many interesting faults and flexures.

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Among the fossil remains worthy of note collected at the foot of Parliament Hill may be mentioned a large sponge referred by Mr. Whiteaves to the genus *Brachiospongia* (Marsh.) This beautiful specimen was obtained by the writer above low water mark in a bed of limestone six inches in thickness, and immediately overlying that containing tracks or trails of marine animals, at one of the geological sub-excursions of the Club, Dr. Baptie being present. It is the first time that the genus has been recognized as occurring in Canada. This Ottawa specimen measures 10 inches or 24·5 centimetres in diameter, and presents seven "brachia," or "arms"—so called. These lobes, more properly speaking, are seen to radiate from a broad circular central portion. There appear between these, in the intermediate spaces, lobes slightly elevated above the general level of the others; whether these are structural or not has not yet been ascertained. The specific reference is still doubtful as microscopic sections carefully prepared by Mr. Weston, of the Geological Survey, have not given definite structure. In certain minor details our specimen differs from either of the three species described by Profs. Owen and Marsh, from the Cincinnati group of Ohio, and whether they are all the same or different species, still remains to be settled.

Associated with it was discovered a series of tracks, probably made by mollusca, resembling in miniature those described by Billings as *Scærichnites*, from the Cambro-Silurian deposits of Anticosti. That they are not referable to Billing's species, *S. abruptus*, is at once evident by comparing the specimens with the description.

The Ottawa specimens are often tortuous in their course, the marks or pits are arranged in an alternating manner, and about three-eighths of an inch is the greatest width of these tracks, there being about twelve steps or series of footprints in the space of twenty-four lines. Ichnites like these are generally supposed to have been molluscan in origin. Amongst the other species of interest collected at the same sub-excursion may be mentioned as of more especial interest, *Ophileta Ottawaënsis* (Billings), *Strophomena deltoidea* (Conrad), *Bucania bidorsata* (Hall), &c. Besides the above, the Trenton formation has also yielded *Amplexopora Canadensis* (Foord), *Pholidops subtruncatus* (Hall), *Illænus trentonensis* (Emmons), a *beyrichia* very difficult to distinguish

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from some of the Cincinnati group species described by Prof. S. A. Miller, as well as a number of species awaiting identification.

A very interesting sub-excursion of the club was held at a short distance from the city in July last, when the writer, in company with Messrs. Craig, Summerby and Dr. Loux, all enthusiastic members and devotees to science, visited a number of interesting exposures in the county of Russell. The Trenton was observed to crop out on the 10th lot of con. 10, Russell, and lot 30 of con. 5 of Cambridge, forming a ridge or elevation above the general level of the country, the measures dipping at an angle of about 15° to the north. There may be a dislocation here, but the exposures were too limited to ascertain. The strike is almost due east and west. Farther up, at Cook's Rapids, on the River Castor, lot 8, con. 9 of Russell, was found a splendid exposure of the Trenton formation for a distance of at least one mile, characterized by abundance of fossils, over twenty species having been collected and recorded from that place, amongst which may be mentioned the *Brachiospongia* referred to already, *Protarea vetusta*, *H. Prasopora Selwyni* (Nich), *Bellerophon sulcatinus* (Billings).

The Utica Formation.—To sum up briefly the results obtained in the very interesting series of bituminous schists and associated impure limestones, it may be said that in the exposures on the Rideau Hall grounds the perfectly conformable position of the Utica on the Trenton, or else the gradual passing of the Trenton measures into those of this formation is very evident. That an unconformability has been assigned to the Utica by many authors is a well-known fact. The measures at Rideau Hall immediately set at rest this question upon examining them. Not only the stratigraphy agrees, but also the mass of palæontological evidence which has already been gathered from this formation, enables one to satisfy himself of the truths of the above statement. There is no discordance of stratification whatever, and, further, there are species and genera which pass from one into the other gradually. In fact it is very difficult, nay, impossible, to give the precise bed which is first characteristic of the Utica.

The uppermost measures of the Trenton have shales between the layers of limestones; the sediment having assumed a more argillaceous

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nature, owing, no doubt, to a depression of the continent and consequent greater depth of the seas in the Utica times.

An important fact has been ascertained with regard to the distribution of the Utica at Ottawa, viz., that it occurs on Bank street, just west of the fault, which runs by the "Supreme Court" building. The Utica was further ascertained to occur on Albert street, from the corner of Kent, 175 feet in an easterly direction, having had to be blasted by the men employed in laying drains, &c. From these shales some beautiful specimens were obtained. The rocks here present a striking resemblance to those of a similar horizon at such a remote distance as Collingwood, on the Georgian Bay. The association of the trilobites, mollusks and bivalve shells, and entomostroca is strikingly the same. *Lyrodesma pulchellum*, *Leperditia cylindrica*, *Asaphus Canadensis*, *Triarthrus becki*, *Lingula Progne*, *Leptobolus insignis* and *Endocerus proteiformis*, all occurring together in same beds both here and at Collingwood in Western Ontario. Amongst the additions to the list of Utica species may be mentioned a new species of monticuliporid—*Batostoma erratica*, Ulrich, MSS. From beautiful sections of this interesting branching polyzoary prepared by Mr. Weston and from drawings excecuted by the same gentlemen, together with Mr. Ulrich's authority, the writer has had an opportunity of identifying the species in question. Prof. Ulrich will soon describe it, and therefore no description is here given of it. It has further been ascertained that the graptolites referred to as *Didymograptus flaccidus* and *annectans* are both referrable to the genus *Leptograptus*.

Hudson River Formation.—Here we have to hail a new era in our geological nomenclature, having to add this formation to the eight others already known about Ottawa, and with which the Club's work has dealt. That the shales and arenaceous beds found on a cutting on the Canada Atlantic railway are of this age may be ascertained from the following list of species found. The cutting is three miles from Ottawa. *Zygospira headi*, *B.* (*O. Erratica*, *H.*), *Orthis testudinaria*, and *opertrinella*, *Modiolopsis modiolaris*, Conrad (*large*), *Modiolopsis pholadiformis* (Hall), *Ambonychia radiata* (Hall) &c., *Cyrtolites ornatus* (Conrad), *Bellerophon bilobatus*—G. B.

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In the post tertiary deposits of Green's creek the writer, in company with Mr. F. A. Dixon, found an interesting coleopterous insect, which is now in the hands of Prof. S. H. Scudder, of Boston, and awaits identification.

REPORT OF THE PALÆONTOLOGICAL BRANCH.

To the Council of the Ottawa Field-Naturalists' Club:

I was unable to attend last summer's Club excursions, but during the autumn I paid some attention to a rich outcrop covering the western portions of lots 3 and 4, concession 3, R. F., Gloucester, County of Carleton. In 1878 Mr. H. O. Wood, P.L.S., pointed out this outcrop to Mr. G. C. Heron, C.E., and myself, and I trust that some enterprising member of this club will visit the locality and work up the exposures thoroughly. The following species, together with many others yet undetermined, are now in my cabinet:

1. Stromatocerium rugosum.
2. Tetradium fibratum.
3. Ptilodictya acuta.
4. Orthis tricenaria.
5. Rhynchonella increbescens.
6. Streptorynchus subtentum.
7. Bucania expansa.
8. B. punctifrons.
9. B. bidorsata.
10. Ophileta ottawensis.
11. Ecculiomphalus trentonensis.
12. Helicotoma planulata.
13. Raphistoma progne.
14. Pleurotomaria subconica.
15. Subulites subfusiformis.
16. S. elongata.
17. Cyclonema halliana.
18. Murchisonia milleri and M. milleri var. perangulata.
19. M. helicteres.
20. Endoceras annulatum.
21. Orthoceras bilineatum.
22. O. multicameratum.
23. O. amplicameratum.

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24. Lituites convolans.
25. Cyrtodonta canadensis.
26. C. obtusa.
27. C. huronensis.
28. C. subtruncata.
29. C. subcarinata.
30. Ambonychia orbicularis.
31. Modiolopsis trentonensis.
32. M. modiolaris.
33. M. meyeri.
34. M. gesneri.
35. Illænus ovatus.
36. I. milleri.
37. Bathyurus extans.
38. Ceraurus pleurexanthemus.

Thirty-eight species and one variety.

I think it is high time that the attention of the club was called to the fact that very little work worthy of mention has been done during the past twenty years in Ottawa Trenton group paleontology. Looking over Canadian scientific pamphlets and periodicals I find but two notable lists of Trenton fossils, one by Mr. J. F. Whiteaves, published in the Canadian Naturalist for 1865, and the other Mr. Ami's list, published in your Transactions No. 5. Mr. Whiteaves' list was of 66 species from the Trenton formation (excluding the Birdseye and Black River) of the Island of Montreal. Mr. Ami's list includes Chazy, Birdseye and Black River, Trenton, Utica and two divisions of the Post Tertiary. Omitting the Post Tertiary, and excluding varieties where their species are also given, we find that Mr. Ami has given us 202 distinct species from the Cambro-Silurian rocks of this locality, as follows :—

Chazy	10	species.
Birdseye and Black River	22	"
Trenton	154	"
Utica	45	"
	231	"
Less 10 marked doubtful and 19 names repeated under two or more formations	29	"
Total number of Cambro-Silurian species.	202	

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With reference to the Trenton group I may mention that this list does not include all the Ottawa fossils described and recorded from that group by E. Billings and others, which fact Mr. Ami mentions in his introduction. These neglected names, which I propose to record are as follows :—

Glyptocrinus ornatus, Report G. S. C. 1853-4-5-6.
Dendrocrinus conjugans, " " "
Carabocrinus radiatus, " " "
Orthis gibbosa, " " "
Cyrtoceras simplex, " " "
Vanuxemia inconstans, Report G. S. C. 1857.
Cyrtodonta subangulata, " "
C. obtusa, " "
C. Canadensis, " "
C. subcarinata, " "
C. rugosa, " "
Bellerophon (Bucania) disculus, Report G.S.C., 1863, pages 166-7.
Eunema strigillata, " " "
Helicotoma planulata, " " "
Matheria brevis, " " "
M. obtusa, " " "
Modiolopsis meyeri, Palæozoic Fos., Vol. I, G. S. C.
Cœnodonta abrupta, " " "
Orthis porcata, " " "
O. retrosa, " " "
Illænus angusticollis, Canadian Nat. and Geol., 1st series, Vol. 4.
Strophomena (Streptorynchus) fluctuosa, " " Vol. 5.
S. camerata, " " "
Pleurotomaria progne, " " "
P. americana, " " "
Gomphoceras præmaturum, " " "
Calapœcia canadensis, Canadian Nat. and Geol., 2nd series, Vol. 2.

All the above were recorded by E. Billings, and the following by Prof. Nicholson :—

Ptilodictya fenestelliformis, Report Paleontology of Ontario, 1875.
Strophomena rhomboidalis, " " "

Twenty-seven species recorded by E. Billings and two by Prof. Nicholson, in all twenty-nine.

Of species observed by myself in this neighbourhood, not occurring in Mr. Ami's list and unrecorded by E. Billings or Prof. Nicholson, I may mention the following :—

1. Lingula elongata.
2. Discina pelopea.

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3. Crania setigera.
4. Streptorynchus subtentum.
5. Bucania expansa.
6. B. punctifrons.
7. Subulites elongata.
8. Cyclonema halliana.
9. C. bilix.
10. Holopea paludiniformis.
11. Murchisonia helicteres.
12. Endoceras annulatum.
13. Orthoceras multicameratum.
14. Lituites convolans.
15. Ctenodonta astarteiformis.
16. Cyrtodonta huronensis.
17. Ambonychia orbicularis.
18. Modiolopsis trentonensis.
19. M. modiolaris.
20. Bathyurus extans.
21. Lichas trentonensis.

Twenty-one species.

WALTER R. BILLINGS.

19th February, 1885.

ADDENDUM.

In the Transactions published last year (No. 5, Vol. II, No. 2) certain geological notes by Mr. Walter R. Billings, which were intended by him to appear separately, in a different form, were inadvertently incorporated in the report of the Geological Branch (Page 121).

REPORT OF THE BOTANICAL BRANCH.

This report has unfortunately been mislaid since it was read at the Club Soirée held on 18th Dec., 1884, and as the printing of these Transactions cannot be delayed, its appearance has been postponed to the next number.

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REPORT OF THE CONCHOLOGICAL BRANCH.

To the Council of the Ottawa Field-Naturalists' Club:

GENTLEMEN,—During the past year this section of the club has made gratifying progress in the work assigned to it. In conjunction with the botanical branch, three sub-excursions were held in the early part of the season. The first, to the marl beds east of Hemlock Lake, afforded many of the commoner land shells, such as *Mesodon albolabris*, Say, *Patula alternata*, Say, *Patula striatella*, Anth., *Stenotrema monodon*, Rackett, and *Succinea obliqua*, Say. *Macrocylis concava*, Say, *Hyalina arborea*, Say, *H. viridula*, Mke., and *Conulus fulvus*, Drap., were obtained in less numbers, together with two bleached specimens of *Mesodon sayii*, Binney, and one of *Zonites inornatus*, Say. Both the latter species probably lived in this locality within a very recent period. It is not likely that they long survived the destruction of the forest which once favoured them by equalizing the temperature, preventing rapid evaporation and condensing at night generous supplies of moisture from the atmosphere.

On the way homeward *Campeloma decisum*, Say, *Limnæa desidiosa*, Say, and *Planorbis campanulatus*, Say, were collected in the lake. *Anodonta fluviatilis*, Dillw., was observed in quantity in muskrat heaps at the west end of the lake, but no perfect shells were found, one valve being invariably broken. In one specimen of the *P. campanulatus*, the bell shaped mouth after being fully formed had contracted and continued growing for half a whorl, when another enlarged aperture was formed. The result is *P.* (*Adula*) *multivolvis*, Case, in every particular but one. The shell from Hemlock Lake has only four and a half whorls, instead of the "seven whorls" of Case's somewhat mythical species, which in fact seems to have been nothing more than *P. campanulatus* with the aperture duplicated.

The next expedition was to Dow's Swamp. A halt was made *en route* at the Bank street bridge, where *Valvata tricarinata*, Say, *Limnæa stagnalis*, L., *Physa ancillaria*, Say, *Planorbis trivolvis*, Say, and *P. campanulatus* were collected. Very fine specimens of *L. stagnalis* occur at many points along the Rideau Canal, but nowhere of more graceful proportions and beautiful lustre than in the dead water ex-

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tending from the canal in a westerly direction immediately above the swing bridge. *P. ancillaria* found there is also very beautiful, but except in colour it differs little from the form of *P. heterostropha*, Say, commonly met with. Both species are found in company in a depauperate form around the islands at the foot of the Little Chaudière.

On arriving at the swamp no time was spent in searching for the minute land shells—many very rare—which it produces, but our party at once repaired to the lake in its centre. *Valvata sincera*, Say *Limnæa palustris*, Müll, were present in great abundance, with not a few *Planorbis deflectus*, Say, and *P. exacutus*, Say. The only bivalve previously taken in the lake was *Pisidium abditum*, Hald., but on this occasion, in addition to that species, were found *P. ventricosum*, Prime, and *Sphærium securis*, Say—the former rare and the latter common and more inflated than the shells occurring in the canal.

Later in the season, in the ditch on the opposite side of the railway from Dow's swamp, a small form of *Physa gyrina*, Say, was taken in large numbers.

The third sub-excursion, which took place to Hull, was not attended with very satisfactory results. Along the eastern slopes of the hill overlooking the beaver meadow a few specimens of *Mesodon sayii* were found. *Limnæa emarginata*, Say, and *Physa heterostropha* were taken in Scott's Creek; and in dried up pools beside the railway we noticed myriads of shells of *Limnæa palustris*.

On the general excursion of the club to Kingsmere we obtained *Mesodon sayii*, *Zonites inornatus*, a slug which is probably *Pallifera dorsalis*, Binney, and a great many of the smaller helices. No locality near Ottawa affords so many species of land shells as King's Mountain and the ravines which climb around its sides, but neither the coronal lake near its summit, nor Kingsmere far below, appears to contain a single shell. Many larger lakes in the Laurentides are equally unproductive.

At Mohr's wharf, on the occasion of the excursion to the Chats, *Unio complanatus*, Sol., *U. radiatus*, Lamk., *Limnæa catascopium*, Say, *L. caperata*, Say, and *Planorbis trivolvis* were observed along the shore; and the woods to the south afforded *Mesodon albolobris*, *Patula striatella*, *Hyalina arborea*, *H. viridula*, *H. indentata*, Say, *Conulus*

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fulvus, *Strobila labyrinthica*, *Pupa contracta*, Say, *Succinea ovalis*, and *Tebennophorus carolinensis*, Bosc.

We were absent from the city when the excursions were held to Buckingham and Casselman, but on these occasions the branch was represented by Mr. Harrington. Little worthy of particular mention was observed at Buckingham, but at Casselman an important addition was made to our lists in the large and handsome *Mesodon thyroides*, Say.

Considerable independent work was done by individual members of this section when business cares permitted. On the 3rd and 4th of September a tour was made along La Pêche River, in the County of Ottawa, from its mouth to its source. As far back as Masham post office, the stream, flowing in a gravelly bed, often strewn with boulders, appears to contain only two shells, *Unio complanatus* and *Physa heterostropha*, the latter very large. Before reaching Masham a visit was made to a small and in part shallow lake on the right of the road leading up the valley. It is locally known as Gauvreau's Lake, being named, as is customary in the Laurentides, after a neighbouring settler. It fairly teems with molluscan life. Four species, however, found common there on July 11, 1881: *Annicola porata*, Say, *Limnæa desidiosa*, Say (a small but beautiful variety), *Planorbis deflectus*, and *Spœrium sulcatum*, Lamk., had almost entirely disappeared. *Campeloma decisum* was rare as on the occasion of the former visit to the lake, and a large fine variety of *Planorbis trivolvis* very common. *Unio complanatus*, *U. luteolus*, Lamk., *Anodonta fragilis*, Lamk., and *A. lacustris*, Lea, occurred in the shallows in great abundance, notwithstanding the immense numbers destroyed by muskrats, as bore witness the large heaps of empty shells at short intervals along the shore. In this and other lakes the muskrats tear off one valve of the fragile anodontas, but the thick shelled species, as well as margaritanas and unios, they treat in a different manner, breaking off invariably a small portion of the lower third of the posterior margin. It is not improbable that they then extract the juices of the animal by suction, and when the adductor muscles relax and the valves open the firmer parts become easily accessible. Where thin andontas are rare and occur in company with numerous unios, as at several points along the Ottawa, they are treated

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exactly like the thicker shells. The rats in such places have apparently not learned to distinguish the two genera.

Beyond Masham mills, where the mill dam was undergoing repairs, the muddy river bed was almost dry. The same shells were found here as lower down, and in addition *Campeloma decisum rufum*, *Planorbis trivolvis*, *P. bicarinatus*, Say, *Unio complanatus*, and *Sphaerium sulcatum*. Higher up, the river became rapid and narrow, with a pebbly bottom—a mere mountain brook—and no shells were found in it.

Later in September the outlet from Leamy's Lake was explored. Where it joins the Ottawa a single fine specimen of *Anodonta benedicti*, Lea, was collected. In the same vicinity, and especially at the mouth of Brigham's Creek, the surface of the water near the shore was one warm evening observed almost covered by innumerable univalves floating foot upward. *Physa heterostropha* was the species most abundant. Scarcely less common were *Planorbis bicarinatus* and *P. albus*, Müll., while *P. trivolvis*—a medium sized, robust, dark brown form—and *Limnæa catascopium* were sparingly represented.

As the polyzoa are classed under the mollusca, it may not be outside the *métier* of this branch to mention the occurrence of numerous large colonies of *Pectinatella magnifica* in the bay into which the outlet from Leamy's Lake flows.

With a view to preparing a complete list of the terrestrial mollusks of this vicinity a special effort was made by visiting new localities to collect all the species which occur here. The results, in part successful, have been set forth in a paper recently read before the club.

F. R. LATCHFORD.

4th March, 1885. PASCAL S. POIRIER.

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ADDENDUM.

Correction by Mr. J. F. Whiteaves of Remarks Attributed to him on page 133 (Transactions No. 5).

To the Secretary of the Ottawa Field-Naturalists' Club:

Dear Sir,—On page 133 of vol. 2 of the Transactions of the Ottawa Field-Naturalists' Club some remarks are attributed to me in which my meaning has been misunderstood on two points.

In reference to the first, what I intended to say, and what I believe I did say was, that, as Dr. Lea pointed out long ago, the rivers flowing immediately west from the Alleghanies, such as the Ohio and other tributaries of the Mississippi, contain a different set of Unionidæ to those which inhabit the streams of New England and the more northern Atlantic States which flow eastward from that mountain range. That to the north, in Canada, where no such mountain barrier exists, there is often no such marked distinction between these faunæ, and that this co- mingling may to some extent have been brought about by such artificial means as the construction of canals, like the Welland. At the time the remarks were made it did not occur to me that some of the members present might not be aware of the fact that the Unionidæ of the Pacific slope belong to quite a different fauna to the two already indicated.

Secondly, in regard to the North American species of *Anodonta*, it never entered into my mind to suppose that all the species that have been described from this continent could be regarded as one. My remarks were to the effect that *some* of the so-called species which have so far have been recorded as occurring in Canada (and especially those from the Province of Quebec) have been thought by naturalists of experience to be possibly only polymorphic varieties of the European (and possibly circumpolar) *Anodonta cygnea.*

J. F. Whiteaves.

August 18th, 1885.

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REPORT OF THE ENTOMOLOGICAL BRANCH FOR THE SEASON OF 1884.

To the Council of the Ottawa Field-Naturalists' Club:

As predicted in the report submitted last year, the depth of snow which covered the ground was followed by a great abundance of insects, the hibernated forms of which had been well protected from harm. Although the spring was rather backward and the snow slow in disappearing, the season was earlier than in 1883, and hibernated insects were observed in the beginning of April. The summer was unusually cold and wet, and tended, doubtless, to check in some degree the increase of many species, although, perhaps, favorable to others; the influence of such seasons being yet uncertain. The unusually severe frost of 28th May, which, especially on the north side of the river, was such as to destroy the new wood of many native trees and shrubs, must have destroyed immense numbers of insects, either directly or indirectly. One instance of its effects may be noted. Mr. Pellissier, who lives about three miles from the Wakefield cave, informed us that the failure of the flowers of the raspberry (*Rubus strigosus*), from which his bees gather the greater part of their spring honey, was so complete that he was afraid he would have to sacrifice many of his colonies. The same cause must have been very disadvantageous to our native bees.

While the entomological branch remains deplorably weak in numbers we are able to record the addition to its ranks of two or three members who will doubtless be of great assistance in its work.

During the last session of Parliament the Committee on Agriculture summoned us to give evidence as to the injurious effects of insects, and also as to the advisability of a practical entomologist being appointed by the Government to investigate their ravages. The committee has since published its report, and having recommended that entomological investigations should be made under the control of the Department of Agriculture, one of your leaders has been appointed Entomologist to that department.

HYMENOPTERA.—The collections in this order have been largely increased, and a paper on one section of the species injurious to vegetables is announced on the programme of our soirées. A considerable

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number of species in other families has been determined by Mr. Guignard, who has made a fine collection of these very interesting insects during the past two or three years.

LEPIDOPTERA.—In this attractive order a considerable amount of work has been done, chiefly amongst the diurnals, although the nocturnals have not been altogether neglected, and many new and rare species have been added to our collections. A collection is exhibited this evening of specimens of diurnal lepidoptera, all taken during the year in this locality or bred from the eggs. The leaders cannot do better than urge the members of the Club to take up the study of rearing insects from the egg. The eggs of many species can be obtained with comparative ease; yet hardly anything has been done in this line, and a fruitful field is open for workers. During the past year a commencement has been made, and the results are exhibited to you to-night. The exquisite specimen of *Colias Eurytheme*, winter form *Keewaydin*, in the case was bred from an egg laid by a specimen of the summer form *Eurytheme* so battered that it was hardly recognizable. At the same time a family of twelve specimens of the common Clouded Sulphur butterfly, *Colias Philodice*, were bred with this specimen for the sake of comparison, and were compared daily with important results. This family was chiefly of interest, because it showed conclusively that the white form of female, occasionally found flying with the yellow specimens, is merely a chance variety. Three of the twelve were very fine albinos. This result of obtaining white females from a yellow female had not, we believe, been previously obtained. Other interesting points as to the extent of variation were also demonstrated.

Although an almost complete series has been collected we consider it wiser to postpone for a time the publication of a list of our diurnals, so that additional information may be acquired regarding some of the species.

Among the larger, or rarer, lepidoptera which have occurred during the past season, either in the preparatory or perfect states, mention must be made of the following species. *Actias Luna* was exceedingly abundant in the larval stage near Hull, over thirty caterpillars having been collected in one afternoon, chiefly from the bitter hickory (*Carya amara*). On oaks the larvæ of *Ceratocampa pellucida* were abundant.

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From the white pine about a dozen larvæ of *Ellema Harrisii* were taken, and at the same time three of the curious larvæ of *Platycerura furcilla*. These species feed in a remarkable manner, well worth mentioning. Clasping a twig with their prolegs they pull down a leaf by means of their thoracic feet until the tip is reached, when they feed on it until it is eaten quite down; they then take the next, and so on. Another rare species, to be for the first time recorded in this locality, is *Callosamia Columbia*, of which no less than nine larvæ were found on tamarack (larch) at Stewarton.

The most injurious insect of this order which occurred during the season was the velvety black cutworm (*Agrotis fennica*). The larvæ of this moth attracted attention by their depredations early in May, when they appeared in countless numbers, devouring nearly everything that came in their way, and especially destroying peas and clover. This species, although so numerous this year, had previously been an exceedingly rare insect, and it is probable, judging from the mortality among those kept for study by us, that it will be very scarce again next year. Thousands of the larvæ were killed off by parasites and a fungous disease before reaching maturity.

As leaders of the Entomological Branch we are much pleased to announce that Dr. Selwyn instructed Prof. Macoun to collect lepidoptera when examining the Nipegon district during the past summer, and that the collection made there, although small, was of a most important character, several very rare species having been taken, two of which were new to science.

COLEOPTERA.—The list of coleoptera published in the last number of the Transactions contained, as you are aware, all the species which had been determined up to its publication. During the summer, however, a number of additional species were captured, and some of the unidentified ones have been determined,* so that about one hundred additional species are known. Mention may be made of an enormous congregation of beetles (with which were many other insects) which was observed by us on 4th May at the foot of the slide which brings down sawed lumber from the mills at Chelsea to the piling grounds at

* Chiefly through the kindness of Mr. J. B. Smith and Mr. E. A. Schwarz.

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Ironsides. The slide was not in use on the day in question, and all the insects which fell into it throughout its length of four miles and were carried down by its swift current were arrested at the piling grounds by the boards left floating in the trough. The accumulation numbered many thousands and contained a great number of species, including some very rare ones, but the larger part consisted of various species of Scolytidæ, or bark-boring beetles (chiefly of the pine), Aphodii and Staphylinidæ being next in abundance.

In the remaining orders a number of species have been captured and a certain number named, while steps will be taken to have the remaining insects determined by competent specialists. Mr. T. J. MacLaughlin has commenced the study of our dragon-flies, and if others of our members would only take up the collection and investigation of one or more of the many groups which remain untouched valuable work could be done for the Club and for entomology.

It is suggested that members could find an agreeable task in rearing say a single species, as a complete investigation of the life history of the most common insect would be of much interest and value. The number of species of which a complete history has been gained is small, and new facts would be sure to reward even the beginner in this path of science. To show what important work could be accomplished we may state that one of the leaders has been able to provide Mr. W. H. Edwards with a drawing of the chrysalis of a butterfly (*Neonympha Canthus*) which he had not before been able to obtain, and which rendered complete his illustrations of the various stages of all the Atlantic species of the genus.

W. HAGUE HARRINGTON,
JAMES FLETCHER,
Leaders.

4th December, 1884.

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REPORT OF THE ORNITHOLOGICAL BRANCH.

To the Council of the Ottawa Field Naturalists' Club :

The work in this branch during the past season has been very satisfactory, and the leaders are able to report no less than nine additions to the already large list of Ottawa birds published by the Club, bringing the total number of species recorded from this locality up to two hundred and six. Interesting notes were taken at some of the Club excursions and working parties, but, as usual, the great bulk of the work was accomplished individually.

Early in the year, circulars were received announcing the fact that the American Ornithologists' Union had taken upon itself the difficult task of collecting material for the more systematic study of the great problem of bird migration, and requesting those willing to assist, to take careful notes on the movements of the birds, and report to the superintendents appointed for the various districts. Both of the leaders agreed to become observers, and reported individually, at stated intervals during the season, embodying in their reports the observations of other members of the Club. The most important part of the information required was the dates of arrival and departure of the different birds, distinguishing between the movements of the bulk of the species and of mere stragglers. The work will be continued during the coming year, and it is hoped that every member of the Club will contribute his mite towards making the reports from this station as full as possible.

The following are the additions made to the list of the birds of this locality already published by the Club. The numbers refer to Cones' "Check List of North American Birds" 1882 edition :

136. *Siurus nævius* (Bodd) Cones. Water Thrush. A young bird of this species was shot by Mr. W. L. Scott, on the Club excursion to the Chats Fall, held on July 24th. When shot it was running along the side of the steep, rocky bank, which skirts the Ottawa River a few miles below the falls. The locality is distant about thirty miles from Ottawa. Mr. Scott observed another individual at Gallway's Lake, in the Laurentian Hills, on July 9th ; and a third was noted by Mr. F. R. Latchford at the Little Chaudiere early in August.

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188. *Lanius ludovicianus excubitorides* (Sw) Coues. White-rumped Shrike. A pair of these birds, both young of the year, were shot on June 28th by Mr. Scott, some four miles from the city, on the Quebec side of the river. There were, in all, a family of five, but the other three escaped. The stomachs of the two obtained were kindly examined by Mr. W. H. Harrington, with the following result:

"Young Shrike (male). Full of insect remains, including portions of a beetle, *Harpalus* (*Pennsylvanicus ?*) and of a large, black cricket.

"Young Shrike (female). Contents less, and more finely ground up. Apparently all insects, including abdomen of weevil, *Otiorhynchus ligneus*, head of large black wood ant (worker or soldier) and head of some large ichneumon (*Hymenoptera*)."

242. *Melospiza linconi* (And.) Bd. Lincoln's Song Sparrow. A male of this species was shot by Mr. Geo. R. White, on the 16th May, near the east end of the city.

388. *Empidonax flaviventris* Bd. Yellow-bellied Flycatcher. One shot in a poplar tree, at the eastern extremity of the city, on May 26th, by our indefaticable junior ornithologist, Master Ted White.

482. *Nyctala tegmalmi richardsoni* (Bp.) Ridg. Richardson's Owl. Two specimens were secured by Mr. Geo. R. White; the first on Jan. 1st, 1884, and the second on Nov. 29th, 1884.

495. *Accipiter cooperi*, Bp. Cooper's Hawk; Chicken Hawk. Master Ted White shot one of these hawks towards the latter part of August, 1882. A specimen was also obtained on April 14th, 1884, by Mr. Geo. R. White.

516. *Buteo borealis* (Gm.) V. Red-tailed Buzzard Hawk; Hen Hawk. A young example of this hawk was caught alive in a barn, by Mr. Freeman, of Bowsville, Nepean, on Dec. 31st. The bird had entered the barn in pursuit of some hens. The specimen was subsequently killed and was mounted by Mr. Coleman.

695. *Chen hyperboreus* (Pall.) Boie. Snow Goose. On Nov. 1st., a bird of this species was "put up" from a stubble field on the Ontario side of the Ottawa, by Mr. Herring, the taxidermist to the Canadian Geological and Natural History Survey. Although he did not succeed in obtaining the bird, Mr. Herring is quite positive as to

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its identity. A specimen is also said to have been shot just above the falls, some eighteen years ago, by the late Dr. Van Courtland. The head and wings were preserved, and remained in the museum of the Ottawa Literary and Scientific Society, until destroyed by moths.

847. *Podiceps griseigena holbœlli* (Reinh.) Coues. American Red-necked Grebe. In October, 1881, Mr. Whitcher shot a young male of this species, out of a flock of 8, on Campbell's Bay, some twenty-eight miles below the city. The specimen was mounted, and is at present in the office of the Deputy Minister of Fisheries.

The following birds, rare in this locality, or recently added to our local list, were noted during the season :

13. *Turdus ustulatus swainsoni* (Cab.) Coues. Olive-backed Thrush. Master Ted White shot 4 of these birds, in a swamp near Beechwood, on May 24th ; and Mr. Geo. R. White shot one near the same place on Sept. 24th.

134. *Dendrœca pinus* (Bartr) Bd. Pine-creeping Warbler. Although far north of what is usually considered the northern limit of this species, it seems a not very uncommon bird with us. Master Ted White shot a specimen on the 8th of May last, making the fifth recorded from this locality.

142. *Geothlypis philadelphia* (Wils.) Bd. Mourning Warbler. On July 21st, an adult female of this rare warbler was obtained by Mr. Scott. It was shot in a small beaver meadow near Pelissier, in the Laurentian Hills, twenty-four miles north of Ottawa. The stomach was kindly examined by Mr. Fletcher, who reports as follows :

"The contents of the Mourning Warbler's stomach were—

1. Three of the large jumping legs and several parts of the wings of a Tettix.
2. Fifteen thoraces of some small Hemipterous insect, probably *Neides spinosus*. I am sorry to have to record that this is a beneficial insect.
3. One wing of a Hemipterous insect, showing the characteristic end of the hemelytron.
4. Four curved *ova*, about one line in length, of a deep yellow colour, probably of the above mentioned tettix.
5. Part of a blue elytron of some small Coleopterous insect.

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The rest of the contents of the stomach was made up of parts of legs and bodies of insects, quite undistinguishable from partial decomposition."

173. *Vireo philadelphicus*, Cass. Brotherly-love Vireo. Master Ted White secured one of these vireos—apparently very rare with us—in his father's garden, on Sept. 4th.

176. *Vireo flavifrons*, V. Yellow-throated Vireo. A pair shot by Mr. Geo. R. White, near Beechwood, on May 15th. Mr. Scott shot a young female, near Pelissier, on July 21st. There were two of them, chasing each other from tree to tree, but only one was obtained. The stomach, as examined by Mr. Harrington, contained "a large striped caterpillar, several smaller caterpillars, and some small fragments, probably of coleoptera."

177. *Vireo solitarius*, V. Blue-headed Vireo. These birds appear to have been rather common last autumn. Mr. Geo. R. White shot two on the 28th of September, and Master Ted White obtained a pair on the 30th of the same month. Mr. Scott noted them on September 6th and 14th, and shot one on September 15th, and another on September 19th. Mr. Harrington examined the stomachs of the last two, with the following result:

"Solitary Vireo (shot Sept. 15th). Contents small. One caterpillar skin, and remains of *Hemiptera* (?)

"Solitary Vireo (shot Sept. 19th). Hemipterous remains chiefly. Fragments of a species of *Podisus*."

212. *Chrysomitris pinus* (Bartr.) Bp. Pine Linnet. Mr. Geo. R. White noted these birds as late as May 15th last spring, and again on August 15th. A pair were shot by Mr. Galpin of Rideau Hall, on October 6th.

227. *Passerculus sandvicensis savana* (Wils.) Ridg. Common Savanna Sparrow. This sparrow, although overlooked until last year, appears to be quite common. At Casselman, 30 miles south of us, it is apparently the commonest sparrow, and is very abundant.

282. *Passerella iliaca* (Merr.) Sw. Fox Sparrow. Master Ted White succeeded in securing two of these handsome sparrows, the first on May 2nd, in his father's garden, and the second beyond Beechwood, on the 3rd September.

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524. *Buteo pennsylvanicus* (Wils.) Bp. Broad-winged Hawk. Although so long overlooked, this species appears to be one of our commonest hawks, and quite a number were obtained during the year. Mr. Harrington examined the stomach of a female of this species, shot on July 16th by Mr. Scott, and found it to contain "a mass of hair (mouse ?) with a number of seeds intermixed. Also the skin (almost entire) of a large *sphinx* caterpillar, and remains of a large beetle, *Osmoderma scabra* (Scarabaeidæ)." The presence of the seeds is very extraordinary, unless, as may have been the case, they were originally in the stomach of the mouse.

617. *Actodromas bonapartii* (Schl.) Coues. White-rumped Sand piper. On October 27th, Mr. Herring noted a number of these birds, on the Rideau, near the rifle range. He secured two, which are now mounted, and in the collection of the Survey. Master Ted White also shot two on the 8th of October, and one on the 18th.

788. *Chroicocephalus philadelphia* (Ord.) Lawr. Bonaparte's Rosy Gull. Three specimens were shot on May 31st, at Kettle Island, by Mr. Bruté. There is only one other recorded instance of the occurrence of this gull in the vicinity of Ottawa.

The following is a list of birds giving the dates on which they were first observed in the spring of 1884 :

Feb'ry	20	—*Eremophila alpestris*, Shore Lark (a pair).
March	14	—*Turdus migratorius*, Robin (one).
"	15	—*Astragalinus tristis*, Goldfinch (a flock).
"	15	—*Eremophila alpestris*, Shore Lark (abundant).
"	22	—*Turdus migratorius*, Robin (abundant).
"	23	—*Junco hiemalis*, Junco.
"	24	—*Quiscalus purpureus æneus*, Bronzed Crow Blackbird.
"	24	—*Melospiza fasciata*, Song Sparrow (several).
"	25	—*Sialia sialis*, Bluebird.
"	25	—*Agelæus phoeniceus*, Red-winged Blackbird.
"	27	—*Sayiornis fusca*, Peewee or Phœbe.
"	27	—*Clangula glaucium*, Golden-eye.
"	28	—*Spizella socialis*, Chipping Sparrow (one).
"	29	—*Carpodacus purpureus*, Purple Finch.
"	29	—*Accipiter fuscus*, Sharp-shinned Hawk.
April	1	—*Sturnella magna*, Meadow Lark.
"	1	—*Molothrus ater*, Cowbird.
"	7	—*Larus argentatus smithsonionus*, Herring Gull.
"	9	—*Iridoprocne bicolor*, White-bellied Swallow.

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April 9—*Contopus virens*, Wood Peewee.
" 14—*Poœcetes grammineus*, Grass Finch.
" 14—*Accipiter cooperi*, Cooper's Hawk.
" 14—*Anas obscura*, Black Duck.
" 15—*Ceryle alcyon*, Belted Kingfisher.
" 15—*Pandion haliaëtus*, Osprey, Fish Hawk.
" 16—*Spizella monticola*, Tree Sparrow.
" 16—*Tringoïdes macularius*, Spotted Sandpiper.
" 17—*Mergus cucullatus*, Hooded Merganser.
" 17—*Passerculus sandvicensis savana*, Savanna Sparrow.
" 19—*Colaptes auratus*, Golden-winged Woodpecker.
" 19—*Hirundo erythrogastra horreorum*, Barn Swallow.
" 20—*Melospiza palustris*, Swamp Sparrow.
" 23—*Turdus unalascæ nanus*, Hermit Thrush.
" 24—*Petrochelidon lunifrons*, Cliff Swallow.
" 24—*Bernicla canadensis*, Canada Goose.
" 24—*Progne subis*, Purple Martin.
" 24—*Sphyropicus varius*, Yellow-bellied Woodpecker.
" 25—*Colymbus torquatus*, Loon.
" 26—*Spizella socialis*, Chipping Sparrow (abundant).
" 26—*Dendrœca coronata*, Yellow-rump Warbler.
" 26—*Totanus flavipes*, Yellowshanks.
" 27—*Regulus calendula*, Ruby-crowned Kinglet.
" 27—*Scolecophagus ferrugineus*, Rusty Grackle.
" 28—*Regulus satrapa*, Golden-crested Kinglet.
" 30—*Zonotrichia leucophrys*, White-crowned Sparrow.
" 30—*Certhia familiaris*, Brown Creeper.
" 30—*Gallinago wilsoni*, Wilson's Snipe.
May 1—*Ardea herodias*, Great Blue Heron.
" 1—*Chætura pelasgica*, Chimney Swift (one or two).
" 2—*Passerella iliaca*, Fox Sparrow.
" 2—*Chaetura pelasgica*, Chimney Swift (thousands).
" 3—*Dendrœca palmarum*, Yellow Red poll Warbler.
" 3—*Buteo peunsylvanicus*, Broad-winged Hawk.
" 3—*Circus cyaneus hudsonius*, Marsh Hawk.
" 3—*Falco sparverius*, Sparrow Hawk.
" 3—*Cotile riparia*, Bank Swallow.
" 6—*Troglodytes domesticus*, House Wren.
" 7—*Dendrœca caerulescens*, Black-throated Blue Warbler.
" 8—*Dendrœca pinus*, Pine creeping Warbler.
" 9—*Anthus ludovicianus*, Brown Lark.
" 9—*Dendrœca aestiva*, Summer Yellowbird.
" 10—*Antrosomus vociferus*, Whip-poor-will (heard).
" 12—*Tyrannus carolinensis*, Kingbird.
" 13—*Icterus galbula*, Baltimore Oriole.
" 13—*Harporhynchus rufus*, Brown Thrush.

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May	13	—*Geothlypis trichas*, Maryland Yellow-throat.
"	15	—*Dolichonyx oryzivorus*, Bobolink.
"	15	—*Vireo flavifrons*, Yellow-throated Vireo.
"	15	—*Rhyacophilus solitarius*, Solitary Sandpiper.
"	15	—*Mimus carolinensis*, Cat-bird.
"	16	—*Myiarchus crinitus*, Great-crested Fly-catcher.
"	16	—*Melanerpes erythrocephalus*, Red-headed Woodpecker.
"	16	—*Melospiza linconi*, Lincoln's Finch.
"	16	—*Dendrœca maculosa*, Black-and-Yellow Warbler.
"	17	—*Cordediles propetue*, Night Hawk.
"	17	—*Zameloida ludoviciana*, Rose-breasted Grosbeak.
"	17	—*Siurus auricapillus*, Golden-crowned Thrush.
"	18	—*Turdus fuscescens*, Wilson's Thrush.
"	18	—*Trochilus colubris*, Ruby-throated Humming-bird.
"	19	—*Myiodioctes pusillus*, Green Blackcapped Flycatching Warbler
"	19	—*Dendrœca blackburnæ*, Blackburn's Warbler.
"	19	—*Setophaga ruticilla*, American Redstart.
"	19	—*Vireo olivaceus*, Red-eyed Vireo.
"	20	—*Dendrœca pennsylvanica*, Chestnut-sided Warbler.
"	20	—*Dendrœca virens*, Black-throated Green Warbler.
"	21	—*Dendrœca striata*, Black-poll Warbler.
"	21	—*Ampelis cedrorum*, Cedar Bird.
"	22	—*Vireo gilvus*, Warbling Vireo.
"	23	—*Dendrœca castanea*, Bay-breasted Warbler.
"	24	—*Pyranga rubra*, Scarlet Tanager.
"	24	—*Turdus ustulatus swainsoni*, Olive-backed Thrush.
"	24	—*Coccygus erythrophthalmus*, Black-billed Cuckoo.
"	25	—*Passerina cyanea*, Indigo-bird.
"	26	—*Empidonax flaviventris*, Yellow-bellied Fly-catcher.
"	31	—*Actodromas minutilla*, Least Sandpiper.
June	1	—*Mniotilta varia*, Black-and-White Creeper.

The winter birds were last seen on the following dates:

March	16	—*Plectrophanes nivalis*, Snow Bunting.
April	10	—*Pinicola enucleator*, Pine Grosbeak (one).
"	14	—*Ægiothus linaria*, Common Red-poll (a flock).
"	18	—*Lanius borealis*, Great Northern Shrike.
May	11	—*Chrysomitris pinus*, Pine Finch.
June	14	—*Loxia curvirostra americana*, Red Crossbill.
July	1	— *do* *do* do
"	4	— *do* *do* do

Last fall the summer birds were last noted on the following dates:

August	25	—*Dendrœca æstiva*, Summer Yellowbird.
Sept.	3	—*Passerella iliaca*, Fox Sparrow.
"	4	—*Dendrœca pennsylvanica*, Chestnut-sided Warbler.
"	4	—*Vireo philadelphicus*, Brotherly-love Vireo.

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Sept. 5—*Mniotilta varia*, Black-and-White Creeper.
" 5—*Myiodioctes pusillus*, Green Black-capped Fly-catching Warbler.
" 6—*Vireo solitarius*, Blue-headed Vireo (first seen).
" 13—*Turdus fuscescens*, Wilson's Thrush.
" 14—*Parula americana*, Blue Yellow-backed Warbler.
" 14—*Zonotrichia leucophrys*, White-Crowned Sparrow (first seen).
" 14—*Geothlypis trichas*, Maryland Yellowthroat.
" 16—*Mimus carolinensis*, Cat-bird.
" 18—*Colaptes auratus*, Golden-winged Woodpecker.
" 19—*Ardea herodias*, Great Blue Heron.
" 24—*Turdus ustulatus swainsoni*, Olive-backed Thrush.
" 26—*Passerina cyanea*, Indigo-bird.
" 26—*Dendrœca coronata*, Yellow-rump Warbler (first).
" 27—*Quiscalus purpureus æneus*, Bronzed Crow Blackbird.
" 28—*Pyranga rubra*, Scarlet Tanager.
" 30—*Vireo solitarius*, Blue-headed Vireo (last seen).
October 2—*Vireo olivaceus*, Red-eyed Vireo.
" 5—*Zonotrichia leucophrys*, White-crowned Sparrow (last).
" 6—*Turdus unalascæ nanus*, Hermit Thrush.
" 7—*Spizella socialis*, Chipping Sparrow.
" 7—*Poœcetes grammineus*, Grass Finch.
" 8—*Rhyacophilus solitarus*, Solitary Sandpiper.
" 9—*Carpodacus purpureus*, Purple Finch.
" 16—*Melospiza fasciata*, Song Sparrow.
" 16—*Zonotrichia albicollis*, White-throated Sparrow.
" 18—*Sialia sialis*, Blue-bird.
" 18—*Dendrœca coronata*, Yellow-rump Warbler (last).
" 19—*Spizella monticola*, Tree Sparrow (first seen).
" 26—*Scolecophagus ferrugineus*, Rusty Grackle.
" 26—*Turdus migratorius*, Robin.
" 26—*Junco hiemalis*, Junco (bulk left).
" 27—*Actodromas bonapartii*, White-rumped Sandpiper.
Nov'br 1—*Ceryle alcyon*, Belted Kingfisher.
" 1—*Chen hyperboreus*, Snow Goose.
" 6—*Sturnella magna*, Meadow Lark.
" 8—*Eremophila alpestris*, Shore Lark.
" 10—*Spizella monticola*, Tree Sparrow (last seen).
" 10—*Junco hiemalis*, Junco (last).
" 11—*Astur atricapillus*, Goshawk (male).
Dec'br 3—*Corvus americanus*, Crow (individuals are resident).
" 17—*Hylotomus pileatus*, Pileated Woodpecker (probably resident—two were shot early in February, 1884).
" 22—*Accipiter fuscus*, Sharp-shinned Hawk.
" 26—*Certhia familiaris*, Brown Creeper (probably resident).

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The winter birds were first noticed on the following dates :

August 15—*Chrysomitris pinus*, Pine Finch.
October 20—*Plectrophanes nivialis*, Snow Bunting.
Nov'br 8—*Pinicola enucleator*, Pine Grosbeak (one).
" 29—*Ægiothus linaria*, Common Redpoll.

W. L. SCOTT.
GEO. R. WHITE.

14th January, 1885.

REPORT OF THE ZOOLOGICAL BRANCH.

To the Council of the Ottawa Field Naturalists' Club :

In making up the report of the proceedings and researches of this branch during the past season, the same fact presents itself, which was alluded to in our previous report, viz. : What is left for us to report when the various sub-branches of zoology have been so ably dealt with by their respective leaders? But it affords us much pleasure to state that the appeal made by us last year for members of the Club to note down any interesting facts, has been partially responded to, and it is to such notes that this report mainly owes its appearance. We again request that all observations of any interest whatever be recorded this year for further use.

Whilst the various branches of animal life, birds, insects, molluscs, &c., have occupied the attention of the Club, very little notice has been paid to mammals. We had hoped to be able to prepare, as an appendix to this report, a complete list of the mammals met with in this vicinity, but as several data are not verified, we have deemed it more expedient to delay till next year this list, which we then hope to lay before you verified and as complete as possible.

The remark in our president's inaugural address that it would astonish an ordinary observer, as well as many of our members, if they only knew the close proximity of many mammals in their daily walks, which are invisible from various causes is quite correct. One of the chief of these is the fact that many are nocturnal in their habits, and lie concealed by day, whilst the passer by their retreat little dreams of their nearness. How many of us, during our rambles, ever saw a

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racoon, for instance, or a porcupine, and yet the former are not uncommon, and the latter not excessively rare. The weasel family are seldom visible, and the ground-hog is too wary to expose itself to every passer by.

To Mr. R. J. Devlin, of this city, who, from practical experience, is perhaps the best authority on the subject, your leaders are indebted for the subjoined list of fur-bearing animals of this district. He reports the beaver, (found in the Blanche and Lievre tributaries), the black-bear, otter, mink, muskrat, racoon, red fox, silver-grey fox, (rare) cross-fox (a cross between the grey and red), marten, skunk, weasel, fisher, lynx, and in rare instances the wolf. The latter is becoming very rare in this district. There is great doubt if the wild-cat is found here at all. Settlers have a habit of confounding the lynx, wild-cat and wolverine, although the latter does not exist here. One specimen some years ago was obtained and brought here from the Desert River, but apparently it was a rarity.

We noticed an unusually large number of racoons offered on our market last autumn, and the carcases of some we examined were remarkably fat. Enquiry showed that they were all taken near here, and Mr. Devlin's experience convinces him that this animal does not disappear before civilization, but rather becomes more numerous, especially where corn is grown in any quantity in the neighbourhood of woods or swampy thickets where hollow trees and stumps abound.

Reference was made in the last report to the probability of the jumping mouse *(Zapus hudsonius)* being found here, as it was recorded existing at Prescott. This probability has become a fact, as Professor Macoun reports these little creatures being seen in Major's Hill Park last season.

Field mice *(Arvicola)* are reported to have committed unusual devastation last winter. Mr. W. L. Scott states that in some places he noticed the underbrush totally destroyed for a distance of 25 or 30 yards, and that trees six inches in diameter were in some instances girdled and killed by them, and in the early spring the grass was literally a network of their runways. Mr. Harrington also states that near Hemlock Lake mice committed great ravages, and numbers of maples from two to eight inches in diameter were barked to the height

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of one or two, and even more feet, and that acres of saplings and shrubs were destroyed. It will be a matter of interest to notice if the same conditions prevail this winter, and if so, to ascertain the cause of the increase of these pests. The wholesale destruction of birds of prey may have much to do with it, as disturbing the balance of nature, but there may be other causes at work.

Mr. Scott, who has closely watched the bats during the past season reports that out of fifteen specimens he secured, all but one were the common bat *(Vespertilio subulatus)*. During the Club excursion to Casselman, Mr. Fletcher obtained a specimen of *V. noctivagans*, and Mr. Gustavus Wickstead, on the 16th December last, found between the windows of his office, in the Parliament Buildings, a specimen of the Carolina bat *(V. scrotinus fuscus)*. This specimen was referred to Dr. Merriam, of Locust Grove, N.Y., who pronounced on its identity, and added that it was a southern species, rarely reaching as far north as New York.

A seal is reported to have been seen quite recently off Gatineau Point. Two years ago a seal was shot by Mr. Askwith opposite to New Edinburgh, and solitary individuals have been from time to time seen in former years about the openings in that vicinity formed by the currents of the Ottawa River. It is a matter for enquiry what induces these marine animals to come thus far in our inland waters; whether driven up from tide water by storms they lose themselves, or whether they follow the migration of any particular species of fish. If the latter, it might throw some light on the winter movements of our fresh water fish.

Allusion was made in the last report to experiments being carried on by Mr. Scott, with two wood frogs *(Rana temporaria sylvatica)*. He now reports that his specimens lived some ten weeks, but refused all food during captivity. He attributes their death, not to want of food, but to placing them too suddenly in the sun, as they began to show great liveliness with the approach of spring. From experiments continued with other frogs, Mr. Scott found they would never eat anything already dead, as they absolutely refused anything that did not move. Living insects and butterflies they took greedily. The pickerel frog. *(R. palustris)*, reported to have been found by him in Patterson's

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Creek, and mentioned in last years' report, is now supposed to have been the young of *Rana clamitans*, and no genuine specimen of *R. palustris* has yet been found in this vicinity. The 9th of April is the earliest date recorded last year, as far as we can ascertain, when the first frog was seen, and by the 13th their croaking was heard commonly On the 1st May toads were observed making their way to the water in great numbers to spawn, and on the 13th April tree toads were heard piping in ponds.

The first snakes were seen unusually early, two garter snakes *(Eutænia sirtalis)* having been observed by Mr. Harrington on the 14th April, before the snow was out of the woods. A fine specimen of the milk snake *(Ophibolus doliatus triangulus)* was captured by Mr. Latchford, on the Club excursion to Kingsmere, 22nd May. This species appears to be rare in this district.

On 20th April Mr. Latchford found a large spotted salamander *(Amblyostoma punctatum)* under a log, on frozen ground, almost liteless. This is only the second specimen recorded as taken here. On the same day Mr. Harrington found Jefferson's salamander under stones on a wooded slope near the Hull Cemetry. On 22nd May, Mr. D'Arcy Scott took the first specimen ever recorded in this locality of the two-striped salamander *(Spelerpes bilineatus)*. It was found near Kingsmere, and was identified by Dr. Merriam, who was present on that occasion.

On the 21st August Mr. Harrington procured two specimens of the spotted triton *(Diemyctylus viridescens)* during the Club excursion to Casselman.

No fresh observations have come under our notice with respect to fish during the past year, except the fact that the number of sheepshead *(Hoploidonotus grunniens)* offered for sale on our market is increasing. The reappearance of this species in the Ottawa was alluded to in last year's report.

Before closing this report we again call attention to the valuable aid afforded by recording the dates of the first appearance of various animals. Every note made at the time, however insignificant, may have some bearing on facts connected with zoological research.

The whole respectfully submitted,

H. B. SMALL.
WM. P. LETT.

5th February, 1885. *Leaders.*

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Abstract of Meteorological Statistics at Ottawa, June 1884 to May 1885, inclusive, by A. McGill, M.A.

	Months.												
	1884.							1885.					
	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mrch	April	May.	Year.
Average height of barometer at 32° and reduced to sea level	30·047	29·776	29·973	29·995	30·063	29·984	30·094	29·997	29·967	29·987	30·007	29·925	29·9846
Highest barometer	30·540	30·032	30·356	30·534	30·606	30·472	30·790	30·723	30·463	30·449	30·511	30·242	30·790
Lowest barometer	29·660	29·478	29·542	29·470	29·555	29·242	29·148	29·136	29·074	29·364	29·329	29·475	29·074
Monthly and annual ranges	0·880	0·554	0·814	1·064	1·051	1·230	1·642	1·587	1·389	1·095	1·182	0·767	1·716
	°	°	°	°	°	°	°	°	°	°	°	°	°
Average temperature of the air	69·14	66·12	68·85	61.98	44 77	30 16	16·28	11·99	4·40	12·25	36·16	55·27	39·78
Difference from average (9 years)	+2·91	−4·00	+0·95	+3·97	−3·56	−1·41	+0·08	+1·18	−7·95	−10·65	−1·48	−0·23	−1·68
Highest temperature	93 9	93·3	94·2	89·0	73·6	50·8	47·2	44·0	32·4	35·7	75·0	82·2	94·2
Lowest temperature	36·6	42·1	34·1	29·2	20·7	8·0	−28·3	−21 4	−26·9	−20·6	4·3	24·0	−28 3
Monthly range	57·3	51·2	60·1	59·8	52·9	42 8	75·5	65·4	59·3	56·3	70·7	58·2	122·5
Average maximum temperature	82·9	77·1	80·0	72·5	53 0	36·8	23·6	20·8	14·1	22·2	44·2	65·5	..
" minimum temperature	51·2	54·1	53·0	47·9	35·8	21·9	7·8	2·8	−7·0	0·7	24·4	42·5	..
" daily range	31·7	23·0	27·0	24·6	17·2	14·9	15·8	18·5	21·1	21 5	19·8	23·0	21·51
Average pressure of vapour	0 500	0·504	0·543	0·467	0·253	0·153	0·109	0·078	0·054	0·077	0·186	0·326	0·271
Average humidity of the air	70	79	81	84	80	88	91	86	89	83	82	73	82
" temperature of the dew point	59·0	59·2	61·3	57·1	40·6	28·0	20·2	18·0	4·7	12·7	32·7	47·2	..
Amount of rain in inches	1·83	3·72	2·82	3·75	2·73	1·16	2·70	0·19	0	R	3·32	1·53	23.75
Difference from average (9 years)	−0·25	+1·82	+1·01	+0·94	+0·20	−0·09	+2·18	−0·44	−0·68	−0·99	+2·38	−1·26	+4·82
Number of days of rain	8	13	9	17	16	7	5	1	0	1	5	9	91
Amount of snow in inches	..	..	.	..	S	7·5	16·0	7·3	22·5	20·9	46·5	S	120·7
Difference from average (9 years)	..	..	..	..	−2·0	−3·0	−11·9	−14.5	+ 4·1	+ 0·6	+42·8	−0·1	+16·0
Number of days of snow	.	..	..	..	2	5	8	9	10	11	6	1	52
Percentage of sky clouded	28	58	34	44	70	65	68	59	41	43	45	45	50
Average velocity of wind (in miles.)	2·80	2·98	2·38	2·76	4·52	8·46	7·21	9·03	7·85	8·26	7·06	6·42	5·81

Auroras not observed.

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OTTAWA FIELD-NATURALISTS' CLUB

Transactions No. 7

VOLUME II. No. III.

OTTAWA, CANADA:
Citizen Printing and Publishing Company, Metcalfe St.

1887.

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OTTAWA

FIELD-NATURALISTS' CLUB.

TRANSACTIONS NO. 7.

VOL. II. NO. III.

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ANNUAL REPORT OF THE COUNCIL.

To the Members of the Ottawa Field-Naturalists' Club:

The Council has pleasure in reporting that the work of the Club was successfully carried on during the past year. The number of new members elected was not nearly so large as in previous years, being only fourteen, but the membership may now be considered to have reached a point where a marked increase can be secured only by special effort on the part of each member.

One corresponding member was elected, the Rev. Abbé Provancher, of Cap Rouge, P. Q., who has rendered assistance to some of the members of the Club in various branches of natural science.

The Club Excursions were only three in number, owing partly to the prolongation of the last Session of Parliament, and partly to a somewhat unfavourable season. The first one was to Meech's Lake, on the 4th June, and, notwithstanding that the morning was showery and threatening, there was a good attendance. On the second excursion the Club went by steamer up the Canal to Long Island, a locality not previously visited by an excursion of the Club. Although held on the 14th of August, the day was chilly, rather than summer-like. The third excursion was to Brittania, on the 19th of September, and was well attended and most enjoyable, the day being bright, but cool.

The Saturday afternoon Sub-Excursions, or working parties, were more numerous and more successful than in any previous season, and were continued to late in Autumn. Many points in the neighborhood of the city were visited, and much was learned concerning the geology and the flora and fauna of our district. The Council was much encouraged by the attendance at, and interest shewn in these sub-excursions, and is convinced that in no department of the Club's work can more good be accomplished. The information gained at these weekly "Outings," and the instructions received from the Leaders of the various Branches could not fail to awaken an interest in field work in those who were present.

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The additions to the Club Library during the year were numerous and valuable, and were received largely in exchange for our Transactions. Owing to the absence from the city during lengthened periods, of different members of the Publishing Committee, and to other unforeseen and unavoidable delays, the issue of Transactions No. 6, (Vol. II, No. 2,) has, the Council regrets to state, only just been made. The number contains 132 pages of letter-press, and two plates illustrating the new spieces of Crinoids described by Mr. W. R. Billings. A new feature will be found in a carefully compiled meteorological table, by Mr. A. McGill. The Transactions contain many valuable papers and should be placed by you in the hands of such of your friends as may be interested in science, or whom you would desire to become so. The cost of publishing them bears heavily upon the very limited resources of the Club, and it is desirable that a certain portion of it should be defrayed by the sale of some of the copies remaining after one has been allotted to each member. The winter course consisted of seven Soirées, of which one was a Microscopical evening very pleasantly and instructively spent in listening to short addresses on various subjects; and in examining slides illustrative of them. By invitation of our Vice-President, Principal Woods, of the Ladies' College, this Microscopical Soirée was held in the commodious assembly rooms of that institution. At the other Soirées valuable papers and reports were read as in former years.

Commencing on 11th January, Afternoon Lectures or classes were given each Monday, the last one having been delivered yesterday, so that the work of the Club has been continued by the Council to the latest possible moment. These classes were ten in number, and the attendance at them was decidedly larger than at those of previous years. The lectures were as follows:—Entomology: three by the President and one by Mr. Fletcher. Mineralogy: one by Rev. Prof. Marsan, (held in Ottawa College). Ornithology: one by Mr. W. L. Scott. Botany: two by Prof. Macoun and two by Mr. R. B. Whyte. By request of Principal McCabe, who was desirous of obtaining for the large number of students under his charge, the advantages of the lectures on Botany, the four lectures on that science were held in the Normal School, and were listened to with much interest by the

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teachers and pupils, as well as by members of the Club and others who were also present.

From the foregoing report it will be observed that six of the meetings were held in the leading Educational Institutions of the city, proving that the Club is being more and more recognized as both able and willing to impart instruction in the Natural Sciences.

The Council has aimed to make the Club the organization naturally to be looked to for information, not only as regards our immediate surroundings, but on natural history in general, and has been pleased to be able to connect its work with that of the educational institutions mentioned. It endeavoured also to attract to the "Outings" and lectures, the student portion of the community, with a view to interesting the young people in its labours, and of educating them to a knowledge and love of nature.

Signed on behalf of the Council,

T. J. MacLAUGHLIN,

16th March, 1886. *Acting Secretary.*

TREASURER'S BALANCE SHEET.

Dr. The Treasurer in account with the Ottawa Field-Naturalists' Club, 1885-86. *Cr.*

RECEIPTS.			EXPENDITURES.		
To Balance from 1884-85.....		$ 21 47	By Excursion expn's, 1st	$23 05	
Membership fees, 1885-86 ..		122 00	" " 2nd	11 35	
Excursion Rec'ts., 1st	$23 50		" " 3rd	11 75	
" " 2nd	12 40				$ 46 15
" " 3rd	11 75		Transactions No. 6.....		100 00
		47 63	Printing		10 00
Soirées		1 50	Postage.....		3 22
Sale of Transactions		10 05	Stationery		2 55
Interest on Deposit.....		65	Book Binding.....		11 90
			Miscellaneous		1 25
			Balance to 1886-87.....		28 25
		$ 203 32			$203 32

T. J. MacLAUGHLIN,

17th March, 1886. *Treasurer.*

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REPORT TO THE ROYAL SOCIETY OF CANADA.

Read at the Fourth General Meeting, May, 1885.

As delegate from the Ottawa Field Naturalists' Club, I am able to report that the past year has been for it one of continued progress and success. Its two-fold work of studying local natural history, and of endeavouring to popularize science has been vigorously prosecuted and its membership has been largely increased. Forty persons joined the Club during the year, of whom several reside in distant parts of the country and have sought to evidence their interest in the welfare of the Club by enrolling themselves in its ranks. The membership is now one hundred and seventy.

Four large excursions were held last summer, at the first of which the Club was honored by the presence of many Fellows of your Honorable Society, and delegates thereto. Sub-excursions or "working parties" were also held on alternate Saturdays during the season, and contributed largely to a fuller knowledge of our geological formations and of our fauna and flora.

At the winter Soirées (six in number) "reports" by the leaders appointed in Geology, Botany, Entomology, Conchology, Ornithology and General Zoology were presented, and the following papers of much interest and value were read:—

The President's Address, H. Beaumont Small, M. D.
The Canadian Otter, W. Pitman Lett.
The Minerals of the Ottawa District, C. W. Willimott.
Wheat, (with special reference to that grown in Ottawa District) Wm. Scott.
Our Saw-flies and Horn-tails, W. H. Harrington.
Local Trenton Fossils, W. B. Billings.

Classes in Botany, Mineralogy and Ornithology were conducted during several weeks; the first named subject under the very interesting treatment of Prof. Macoun being specially attractive to the members and their friends.

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It has been the aim of the Club since its formation to make its published Transactions as complete and valuable as its circumstances will permit, and Number 5, (Vol. II, No. 1, 152 pages) which was published during the year, is one which would be creditable to many older and wealthier societies. No. 6, which is now in the hands of the publishing committee will contain the reports and papers before referred to, as well as annual reports of Librarian, Treasurer, Council, etc.

The Library of the Club has received numerous valuable donations and exchanges, including the magnificent volumes of the Transactions of your Honorable Society, for which I am instructed to convey to you the thanks of the Club.

At the Annual Meeting of the Club, held on 17th March last, the following officers were elected for the year 1885-1886:—

President—W. H. Harrington.
Vice-Presidents—1st, John Macoun; 2nd, S. Woods.
Secretary—J. Fletcher.
Treasurer—T. J. MacLaughlin.
Librarian—W. L. Scott.
Committee—F. D. Adams, Henry M. Ami, Rev. C. F. Marsan.

W. L. SCOTT,
Delegate.

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PRESIDENT'S INAUGURAL ADDRESS.

MR. W. HAGUE HARRINGTON.

(DELIVERED 10TH DEC., 1885.)

Members of the Ottawa Field-Naturalists' Club, Ladies and Gentlemen:

It is related that King Gustavus III of Sweden, during a visit to Paris, was waited upon by a deputation of savants from the Sorbonne, who congratulated him, among other things, on having as a subject and fellow-countryman a scientist so eminent as the chemist Scheele, the discoverer of magnesium. The King, hitherto entirely ignorant of the existence of the celebrated man, concealed as best he could the fact, and as soon as the deputation had retired, sent a message to his cabinet in Sweden that Scheele should be sought out and have the rank of Count conferred upon him. An official was sent forth to make the necessary enquiries, and returned with the information that Scheele was a lieutenant in the artillery, a good sort of fellow, who was a capital shot and played a first-class game of billiards. The Premier, acting on this report, created the fortunate lieutenant a count, and it was only on the return of the King that he became aware of the mistake, and that the renowned scientist was still living in obscurity as far as the court was concerned.

A mistake analogous in its character was made at the last annual meeting of this Club, when a humble sub-officer—a fair sort of secretary and a successful collector of insects—was burdened with honors which might have been gracefully and fittingly borne by one or other of our well-known scientists.

An unfortunate victim to circumstances, I had at that meeting the honor thrust upon me of election to the office of President of this influential Club; an office for which I felt myself totally unfitted in many important and, indeed, essential respects. While appreciating in the highest degree the honor conferred upon me, I am none the less convinced that the selection you made has not conduced to the best welfare of the Club. I have continued to regret that, yielding to the

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representations of my friends, I allowed myself to be elected, instead of persisting to refuse this highest office in the gift of the Club.

My acceptance, albeit reluctant, was, I am still convinced, a serious mistake and detrimental to the interests of the Club, whose Presidents have hitherto been gentlemen having in a large degree the administrative power necessary to the office, as well as personal influences calculated to advance our general interests.

Various causes have combined to prevent the Council elected by you from devoting so much time as in former years to the management of the Club, however willing they may have been to perform the duties undertaken by them.

Yet, in spite of these drawbacks, the Club has made substantial progress, and a large amount of work has been performed in different directions. The membership has not been much augmented, but any such large increase as in past years is perhaps hardly to be hereafter expected. The persons interested in our labours constitute, unfortunately, a small class of the community, and of these, the number who have not already become members must now be few.

Still, if our work is properly organized and performed, we will continue, it is hoped, to awaken in others an interest in natural history, especially in the younger members of the community. These are now being trained in our various schools, and we should use our influence towards having the important truths of natural history presented prominently to them. Then when they leave school with an interest already awakened in the subjects to which we devote our investigations, we may look forward to their becoming fellow-workers with us, in order to continue their studies in sympathetic company. To this end we should strive to make our excursions and our meetings as inviting to them as possible. Largely with this object in view an innovation has been made in our course of meetings for this season; an evening devoted to microscopic inspection of objects selected to illustrate brief papers on popular subjects being substituted for one of the usual papers.

A very gratifying feature of the summer's work was the increased and sustained attendance at the sub-excursions. These collecting parties, held each Saturday afternoon, were sometimes almost as well attended

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as the regular excursions, and the presence of a number of young people was very encouraging. Good results may follow from the start thus made by them, and the collections commenced at these outings may before long become very valuable to their owners, and to all interested in the fauna and flora of this locality.

The printing of the Transactions has been unavoidably delayed, but it is now nearing completion, and when they are shortly issued to you they will be found a valuable contribution toward a knowledge of the natural history of our neighborhood.

A proposal has been made by Dr. May, of the Department of Education of Toronto, that this Club should make an exhibit at the Colonial Exposition, to be held in London next summer. As the Club has no collections, it will be possible to arrange for such an exhibit only by the co-operation and personal labors of those members who have collections in the several branches. Unless a display can be made that will do justice to the Club, and will give to those who may inspect it a proper appreciation of the work performed by us, it will be far better not to attempt one. A great deal of time and a certain amount of expense will be necessitated in the preparation and packing of collections. The cost of transportation will be borne by the Department of Education, which will take charge of them, and make the necessary arrangements for having them properly displayed in the section allotted to the Department.

It would be superfluous for me now to enter at more length into the work of the Club, either as already accomplished, or as planned for the remainder of the year. The reports from the leaders of the various branches will outline the results of our field-operations, while to the annual meeting the Council will, as usual, render an account of its stewardship.

The Inaugural Address by the President of any Society is always looked forward to as one of the most important lectures on its programme; and not unreasonably since the very fact of his election should indicate his ability to select an appropriate topic and to handle it in a suitable manner.

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We had an admirable illustration of this a few evenings ago, when, in this room, we listened to the able and eminently practical address of one of our own members—Mr. W. P. Anderson—in his capacity of President of the Ottawa Literary and Scientific Society. Following him so closely, I feel quite overshadowed, and I sincerely fear that there are some here to-night who will be as much disappointed in my few remarks, as they were interested by his masterly treatment of a profoundly interesting topic.

The papers presented to the Club at these Soirées are, by its Constitution, restricted (and very wisely so) in their range; they must treat of the natural history of the locality, or be descriptive of original work done by the author. A certain license has, however, always been accorded to the President, so that, loosed from the chain that restricts his fellow-workers, he may have an opportunity of reviewing the work accomplished in other places, or of treating some inviting subject in a more comprehensive and liberal manner than he could otherwise do.

I am, however, unable to avail myself in any degree of the opportunity which has occurred to me. My time since the close of the collecting season has been fully occupied, and such portion of it as I could devote to the Club has been utilized in perhaps as useful a manner as the preparation of an Inagural.

I should like to be able this evening to read you a paper on our Hymenoptera, and to accompany it with a list of our species, prepared jointly by my esteemed co-laborer, Mr. Guignard, and myself. The mass of material collected by us during the summer renders it impossible to do so at present, as it will require a great deal of time to determine and arrange the specimens, and involve much correspondence and exchange with entomologists having special knowledge of this order. Many species new to science have also been discovered, and these must be described before they can be entered on our lists.

Unable then to treat of the subject to which my attention has been devoted almost entirely since my election to office, it has seemed quite impossible for me to select any topic which the time at my disposal, limited by work in other directions, would allow me to make of any value or interest to you. I have thought it better not to waste my own time in endeavoring to make a hurried compilation of a sub-

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ject with which I am not familiar, and yours with a paper which would be probably of as little interest, as it would be of permanent value.

My address shall at least have one virtue—that of brevity—to recommend it to you, and shall consist merely of thoughts in connection wtih our pursuits, which have occurred to me within the past few days, but which for want of time have failed to crystallize into symmetrical forms, or to fall into regular combinations.

There is no more a royal road to solving the secrets of nature, than there is to fathoming the profundities of metaphysics, or to mastering the anatomy of dead languages. One must try the nearest by-paths, and must penetrate to her retreat by threading a very labyrinth of trails. But along no path can he far proceed without finding here a clue and there a clue which, if rightly understood, will bring him nearer to the goddess of his search. Her throne is at the converging point of innumerable paths which lead inward from an outlying sea of ignorance. These avenues may be sinuous and oft interrupted, but by them arrive to the pilgrims occasional glimpses of the radiance emanating from the central area. Morass and thicket may intervene, but no matter how treacherous the swamp or intricate the jungle, there will not be wanting objects of present encouragement and of incentive to further effort. At each step the ground will become more solid and the way less rough, so that the slow and wearisome labour of the outset becomes gradually a pleasant and absorbing recreation. The various powers are developed and strengthened by exercise, and progress becomes easier and more rapid with each stage completed.

What has thus been stated figuratively of the investigation of nature is also literally true in many respects. He who keeps to the dusty macadamized highway will have scant opportunity for discovery as compared with one who seeks the winding paths through field and forest. It is true that even along the roadside the observant naturalist will find much to interest and much to study, but after all the objects will be either common, or will belong to some family of aggressive and self-assertive forms. They will be the weeds that follow man along his highways, not the rare orchids that hide in the dim shade of the cedars and are nourished by the rich mould of the swamp. Or they will be

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the sparrows, blackbirds and crows, noisy and troublesome, not the sweet voiced hermit thrush or the shy woodland warblers.

The field-naturalist then must be really of the fields; no collections of dried plants and insects, or series of skins and shells and stones should so engross his attention as to withdraw him from his rightful haunts.

To those who know anything of outdoor life, what a source of enjoyment is this wandering in fields and woods At every step some object of interest is observed; a flower not hitherto noticed; a rare bird resting on its migratory journey to or from the north; a shy animal venturing forth from its secluded home, such, for instance, as the weasel in his winter garb, harmonizing so well with his surroundings, that almost alone by the glitter of his cruel bead-like eyes is he revealed, as he peers cautiously forth from a knot-hole in an old tree.

There are other inhabitants of the thickets to be found even when the ground is deeply veiled with snow and the murmuring of the streams is hushed. The partridge and the hare are still in their haunts, as the country lad well knows who has a line of snares laid across the tamarac or cedar swamp. With what eager uncertainty he visits them each morning, and how merrily he returns if successful in his frosty round.

The wary fox comes nearer to civilization as hunger presses, carrying his explorations as far as the poultry yard; and what a sight it is to see this beautiful animal, not fleeing for his life from a pack of panting, yelping hounds, but tripping his light course across the fields, or playfully rambling with his mate, and indulging in elegant and sportive gambols.

Let not the naturalist then desert the fields even in winter, under the impression that nought remains to observe. When the snow lies deep and the mercury is low, a tramp on snowshoes straight away across country, will have interests of its own, and will in addition make him fitter for the work of the study and cabinet. It is in the winter that these must receive most attention, and the library be made to supplement the work of the field.

No matter how minute our own observations, they can cover but a small part of the innumerable phenomena of nature, and it is absolutely necessary to study the publications of other workers in similar

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fields in order that their discoveries may complete our own; and what is of equal importance, that they may enable us to judge of the value of the conclusions derived from our personal observations.

The naturalist must learn what there is to look for when he goes abroad, and in what manner to prosecute his search, or many of the most noteworthy objects will escape his attention. Mere rambling about the country, no matter how frequent or how prolonged, will not of itself suffice to make a field-naturalist. The bare-footed urchin following a winding stream with his piece of twine and bent pin hanging from a willow switch, is an embryo collector, but unless his attention is directed to something beyond the dangling of a worm or grasshopper before a sunfish's nose, he will never develop into a field-naturalist. Many a man has fished year after year, from boyhood to old age, and known little even of the prey he captured, while of the thousand other things that come so frequently within his sight he was utterly ignorant.

The angler, however, who is not entirely engrossed in his "basket" has rare opportunities of observing the sly frequenters of localities where animal and vegetable life alike are most varied. Along the margins of streams, and in meadows through which they flow, are the haunts and retreats of many of our mammals, reptiles and birds. Here also the rare plants seek retirement from the glare of the open fields, and find the moisture and shade so grateful and necessary to them. Profusion and variety of vegetation produce a corresponding abundance of insect life, which is augmented by myriads issuing from the water, and which, to a certain extent accounts for the number of birds which frequent the vicinity of streams.

How seductive do naturalistic rambles in the field become, when one has made some acquaintance with the multitude of objects which belong there. You come home parched by the heat and weary with walking on the dusty road, and think that it will be long ere you go forth again. But on the morrow when the sun shines, and the gentle south wind blows, you are eager to be forth even at the risk of the same penalties. It seems to you that there is something that you overlooked the previous day, or something that you require again to investigate, and that you should at once go to complete your observations.

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The portion of highway that it is necessary to plod, is as speedily as possible left behind and forgotten; and once more, among the grass and flowers, you hear the songs of birds and the murmur of insects. How many things there are to see, and how swiftly the time speeds, as plant and bird and insect bespeak your attention.

And when at length fatigued by rambling, what couch more restful or inviting than the soft elastic cushion of sward on the slope of an upland pasture, under the shade of some broad beech or oak, and fanned by whispering breezes from the meadows. Or in the pine grove that crowns the hill, how luxurious is the fibrous bed of leaves shed from above, year after year, and how grateful the resinous odor of the air. The shrill continuous song of the cicada may seem the sole sign of life, but it is really one of many. Grains of sawdust trickling down the furrowed bark of an old trunk indicate that a colony of ants are industriously honey-combing the interior, and closer inspection will show continuous columns of these little toilers moving between the ground and the upper portions of the tree. A falling cone proclaims the presence aloft of a squirrel which has temporarily been in a state of unwonted quiet, but which on detection commences to chatter in his most saucy tones. A woodpecker's tap, tap is heard faintly in the distance, and other familiar sounds are soon noted and their producers seen.

And if, lulled by "the murmuring pines," you should yield to slumber's charms, what cunning explorers will come stealing about you. Little "stripes" the chipmunk, will wink and grin at his cousin "bushy-tail," and dare him to venturesome deeds, perchance even to scampering over the prostrate giant. The pretty little wood-mouse will extend its rambles, from the hollow log in which it has its next of fine dry grass, to forage for seeds. Wood-creepers, chick-a-dees, warblers, and perhaps rare birds for which you have long watched and waited, will sport through the branches above you, and twitter and chirp their comments on your appearance.

To observe the varied life of the woods in the closest manner, and to gain a knowledge of the actions and voices of the resident or passing forms, one can do no better than to seek a favorable locality, and then sit or lie motionless until his presence is forgotten, or forgiven. The

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slightest movement will cause the shyer species to vanish, and will check the free motions of many others.

Early morn is, however, the time when the woods ring with the songs of the birds, and are filled with the sights and sounds of prolific life. As the sun gains in the heavens the inhabitants, except the insects, become quiet, and disappear largely from the scene, occupied, perhaps, with their family and household cares. Insects are most abundant during the hottest portions of the day, for these small creatures, with numerous night-flying exceptions, love the light and heat, and clouds or showers send them at once to seek shelter. Toward the close of day bird life becomes once more active for a brief period, and as the shadows deepen the nocturnal forms of life appear.

What a constant succession there is throughout the year of changes and varieties in the surroundings of our rambles. In the spring comes the budding-forth of leaf and flower and the reappearance of the myriad animated things of earth and air and water. It always seems as if nature was holding a jubilee over the departure of the frost king, and the withdrawal of his forces. The songsters, northward wending, fill the thickets with melodious carols as the sun, rising earlier each morn to welcome them, throws his first rays across the tree-tops. Even the cold blood of the reptiles seems to flow more warmly, and their voices pipe full and clear from every pool and swamp. Plant after plant at its appointed time blooms out, increasing yet more the lavish decorations, and the bees, toil they never so briskly, cannot garner all the honeyed sweets they offer. With summer comes the fruitage of the fields, when the strawberry and its succulent relatives entice to the meadows many whom the mere beauties of foliage and flower have no power to charm. Then as flower and fruit fail, and the foliage, tossed and torn by the winds and mutilated by insect foes, has lost its freshness of color, the plants make a final effort to regain their beauty; and with what success one need not ask who has witnessed the wealth of coloring which adorns our trees in autumn. What combinations of scarlet, gold and green our maples wear; how rich the browns and purples of the oak; how the sumach flames out on the hillsides, among the yellows of the birches and poplars. The very ground is hidden by such a brilliant, luxurious carpet that walking over it seems the realization of some

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eastern tale, where palace floors are clad with rich, soft mats from Persian looms.

The winds grow colder and fiercer, and the leaves whirl earthward until the trees stand bare once more, and yet there are patches of bright color remaining here and there. The coral berries of our Canadian holly hold long to the naked twigs, as in a less degree do the larger and more fleshy fruits of the hawthorn. The mountain ash also bravely holds its great clusters of berries as food for the red-breasted grosbeaks. Of winter mention has been previously made, so that the circuit of the year is complete, and each season is found offering something worthy of attention.

One important feature of the winter, that must not be overlooked, is the opportunity it affords of studying and arranging our collections; how, otherwise, should we find the time for this essential work. And as we pursue it what a throng of memories is called up by each specimen; the time and the locality, and, if you were not alone, who your companion was. A sympathetic companion I may here remark adds immeasurably to the pleasure and success of a field trip. Two pair of eyes are better than one, and many things that would have escaped your notice are pointed out by a companion, while, on your part, you will shew him much that is new and of interest.

It should be the aim of each member, who has opportunities to contemplate and enjoy the beauties and wonders offered by our fertile and varied neighborhood, first to avail himself fully of his privileges, and then to endeavor to enrich others with the results of his labours. What has been told is but a page at intervals in the history of our surroundings, and as our President last year pointed out to us, there remains much entirely neglected. To chronicle the movements and habits of our birds alone, would require numerous papers, which might be made deeply interesting to us. Scores of our birds, if carefully studied, would each suffice for a paper, pleasing and valuable.

And so it is in other branches; we have lists, and occasional notes on species, but no completed life histories, except in rare instances, as Mr. Lett's of the Otter. This paper, although not exhaustive, I consider one of the most valuable of our contributions toward a knowledge of

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our animals. It speaks at once of intimate acquaintance with the creatures described, and of a close observance of their habits.

In placing before our fellow-members the record of our labors in the field and in the study, we should, I think, aim to do so in as pleasing a manner as possible; not content merely with exhibiting a well articulated skeleton, but striving to give it the rounded outlines and colours of life. There is a charming quaintness of description found in the works of many old writers on natural history, but to us a certain portion of it is frequently due to changes in the language, and sometimes unfortunately, to the imperfect knowledge which is shown of the subject.

But we need not turn to musty tomes to find charming writings on nature, when we have those of such observers as Grant Allen, Burroughs, Abbot, Merriam, and others that come readily to our memories. These are the books to read on wild winter nights, and to call up familiar forms and voices from all the seasons. They have the flavor of the outdoor world of which they treat. The murmuring of waters; the songs of birds; the breath of summer winds through odorous thickets; the blossoming of flowers; the myriad sounds and forms of nature, animate and inanimate, are stored for us in their pages. Perhaps here or there we find errors, but they are rare, and we who know how difficult it is to avoid mistakes, should be the last to cast a stone at such careful workers.

Sit down with paper and pen and try how much you can write about some species with which you are familiar, and you will probably be surprised to find how little there is regarding it of which you are absolutely certain. Unless your memory for details is much better than mine, I fear your history will be far from exhaustive. It is easy to believe that you are fully acquainted with a certain form, that you know where and when it appears, and its manner of life and reproduction, but when you attempt to record these, doubts commence to flit through your mind and your knowledge seems less assured.

These points I mention merely to accentuate the value of carefully kept and well filled note books, from which to draw in such times of need. These, if the entries are properly made, *i.e.*, on the spot and at the time when the fact noted was observed, are of equal interest and value with any collection, except, perhaps, one of living forms.

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Nearly every true naturalist has, in varying degree, the faculty, not only of artistic perception, but of execution, as evidenced by the illustrations that so many of them prepare to accompany their writings. We need not go beyond our own membership for instances of this, and every one who studies nature should endeavor to cultivate this admirable gift. A few strokes of the pencil are frequently more effective than much labor with the pen.

Crude and incomplete have been the views which I have endeavored to sketch of our duties, pursuits and pleasures as field-naturalists; discursive as rambles in the field, and noting but few of the many important objects which should receive our attention. I cannot hope to have interested all present, but if any have found here or there a suggestive thought, or one illustrative of their own ideas as to our aims and the method of their accomplishment, it will be ample recompense to me for the scant hours which I have been able to devote to the most onerous duty of my office.

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THE BLACK BEAR.

WILLIAM PITTMAN LETT.

Read 14th December, 1885.

The black bear (*Ursus Americanus*), is a native of the Ottawa Valley, as of nearly all the wooded parts of North America; except, perhaps, the south-western portion of the continent. This animal, in a mature state, has three incisors, one canine tooth, or tusk, and six molars, in each side of the upper jaw, and three incisors, one canine and seven molars in each side of the lower jaw. I quote the following description from the "Canadian Naturalist and Geologist," which, from personal observation, I find to be correct:—

"The black bear has very short legs, a somewhat bulky but flexible body, a long head, slightly arched from the nose over the forehead, small eyes and ears high, oval and rounded at the tips. The soles of the feet are short, the hairs projecting slightly beyond the claws, which are short, blunt and somewhat curved. The tail is very short and the fur is long, glossy and soft. The general colour is black, but sometimes varies to brown or yellowish at certain seasons. The sides of the nose are of a fawn colour, and there is sometimes a small white spot on the forehead and throat. The length of the animal is from four to six feet, and large ones, when fat in autumn, weigh from three to five hundred pounds. The female brings forth two cubs in the winter, or at sometime before the hibernating retreat is deserted."

To the foregoing description I would add, that the young of the black bear are produced during the month of March; and also, the singular circumstance attested by all hunters, that before, or after the hibernating season, no she bear has ever been killed showing any evidence of being in a gravid state.

For such a large animal, the cubs of the black bear are exceedingly small. Some that I have seen, apparently a couple of days old, were not any larger than kittens of the same age. Naturalists have been puzzled to account for the singularly diminutive size of the cubs. No reasonable conjecture of the cause can be formed from the anatomical

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structure of the animal. I believe, however, that the same peculiarity distinguishes the young cubs of the grizzly and all the other species of this genus.

Bears feed principally on vegetable food, such as grapes, roots, berries, beech nuts, oats and Indian corn. In plundering the oat and corn fields of the farmer they often meet their death by means of traps, spring guns, and watching from scaffolds by night. In remote places, where they have not been disturbed, on fine evenings, bears always visit fields of corn or oats before sundown, and thus become an easy prey to the watcher, who is seated perhaps twenty feet from the ground, and, as a consequence, safe from being scented by the animals.

Black bears are inordinately addicted to honey, and, like Gulliver among the Lilliputians, they strike on a troublesome trail when they attack a bee's nest. In the late fall they devour the berries of the Rowan tree, the heavy red clusters of which afford them a rich repast. In a place on the slope of one of the mountains north of Chelsea, where I was out deer-hunting last October, a little grove of beautiful Rowan trees which was much trampled down and tattered by bears in getting at the fruit, together with numerous tracks, indicated the very recent presence of these animals in the place. The black bear, when his natural food is scarce, as is the case when the berry or nut crop is deficient, takes boldly to the farm yard, and carries off pigs and sheep, and even kills young cattle when pressed by hunger. Under such circumstances hunger makes him exceedingly fearless. I have known more than one incident in which bears have been killed, in the act of worrying pigs, by a few blows of an axe.

Although a somewhat clumsy animal, the activity of the bear is wonderful. For a mile or two he runs with astonishing speed. When closely pursued by dogs he will take to a tree, up which he can climb rapidly; from which, however, he descends more slowly, head upwards, as soon as it appears safe to do so. A bear will seldom take to a tree when pursued unless to escape from dogs which take hold, or from a large pack that terrifies him. So far as I have observed, bears are very shy and timorous in the presence of man, making off rapidly from the sight or scent of a human being the instant they become assured of either. They are, however, more frightened by the scent—that intang-

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ible terror of the wilds—than by the appearance of man. The she bear, when accompanied by her cubs, will show fight in their defence, if they are meddled with; yet not always with that self-sacrificing devotion which some writers would lead us to imagine. I once had a personal—and it might have been a dangerous—encounter with a she bear, the largest animal of the kind I ever saw. She had two cubs with her, and the result of my stirring interview with this maternal bruin did not give me a very high opinion of her courage, even in the defence of her young. At a distance of six feet she growled savagely, and showed her teeth viciously; but when my gun missed fire twice, she turned tail and ran away with all her speed, leaving her cubs behind her. This little hunting episode occurred in a fine open hardwood bush, with a soft carpet of moist leaves on the ground. I was young then, and thought I could run as fast as a bear; but I shall never forget the ignominious manner in which I was distanced. With my two terriers I chased her to the edge of a swamp about a mile off; and, although I ran back to the starting point, at a good pace, I found her there before me. She would not afterwards allow me to get within shot of her. I wanted badly to kill a bear; but it was in the days of flint locks and short ranges. Had I possessed a Snider, a Ballard or a lightning repeater, I should have laid her out at first sight in half a minute. After all, perhaps the two dogs—although much less dangerous enemies than their master—frightened her more than I did. The cubs were young, and I have often since been glad that my gun missed fire. Black bears are caught in steel traps, and in timber "dead-falls" set in their places of resort. Steel traps are also successfully used at certain trees to which bears are in the habit of resorting for the purpose of scratching the bark, with what intent can only be conjectured. Some have thought that they do it for the purpose of sharpening their claws. Others have imagined that the act is peculiar to the pairing season, and that the tree thus marked becomes the trysting place, and it may be a battle ground. By the height of the marks left on trees by bears, the animals must have stood erect on their hind feet while performing the cat-like operation. I once saw a large balsam tree in the wilds of the Madawaska River, deeply scored and torn by the claws of bears at a height of at least seven feet from the ground. Steel traps are frequently set in corn and

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oat fields where "bear sign" has been found. The usual and most approved mode is to fasten a log of sufficient weight to the chain, which the animal, when caught, drags after him, leaving a well defined trail which can be easily followed. The hunter who follows this trail must be careful that he does not come suddenly or unconsciously upon the fettered animal. A few years ago an old man named John Dennison, a former resident of Ottawa, in crossing a fallen tree, came suddenly upon a large bear which was fast in a trap that he had set, and a terrible encounter only ended with the death of both. When seized the old hunter attacked the furious animal with his hunting knife and succeeded in killing him, but, unfortunately, not until he was himself mortally lacerated. Man and bear were found lying dead together. This happened at Bark Lake, on the Madawaska River.

Bears are possessed of great strength and astonishing activity. I knew an instance where a black bear climbed twenty feet into a tree with a heavy steel trap fastened to one of his hind feet, and a log of at least fifty pounds in weight attached to the chain. Dead-falls for bears are frequently baited with fish, of which they are quite fond. When food is scarce on land, bears have been known to wade and swim in the rivers of British Columbia and other places, for the purpose of catching fish, particularly when the streams are crowded with salmon making their way inland to spawn. They are constantly seen along the coast of the Island of Anticosti devouring herring spawn, which is cast up there in vast quantities by the waves. The black bear is a good swimmer, although much slower in water than a deer. In their rambles through the woods they swim across rivers and lakes, and are often killed in the water by hunters and others in canoes. Should a party without a gun, an axe, or a good stout pole, encounter a bear in the water, I should strongly advise them to steer clear, for, under such circumstances, he would prove a dangerous antagonist. I have heard it said by those who have tried it, that, if a good strong pole is laid across the back of a bear's neck, when he is swimming, he will instantly raise his fore-paws and catch a firm hold of the pole on each side of his head, and by this means draw his head under water and drown himself. It is affirmed that, when in this position, in water, the animal cannot detach his feet from the pole. I have never had an opportunity of

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testing this kind of bear-hunting, but I have sufficient faith in the possibility of its success, to attempt it should a chance present itself. However, all things considered, in an encounter with a bear, I should prefer a double-barrelled shot-gun or a repeating rifle. Sometimes, however, without firearms very clean certain work has been done, even on land, in conflict with a bear. In this connection I shall tell you a story, as nearly as I can recollect it, relating to the killing of a large bear by the late Mr. Billings—the founder of the Billings family here—in the year 1825 or 1826, or earlier, somewhere between Sparks street and the Rideau River. Mr. Billings, accompanied by one of his men, was on his way home, either from the older village of Hull or "The Point," for even Bytown was then unknown, when they encountered a large bear in their path. The animal sat up and apparently disputed the pass. Mr. Billings cut a good hardwood pole about ten feet long, one end of which he sharpened with the axe. This lance-like weapon he handed to his ass'stant and instructed him to walk quietly up and make a strong, quick thrust at the breast of the bear with the sharp end. This was done, upon which the bear grasped the pole with both fore paws, and pulled upon it suddenly and with such force as drew the weapon further into the wound. Just at this crisis of affairs Mr. Billings quickly stepped forward and finished the business with a few blows of his axe. In illustration of the danger to be apprehended from a wounded bear, I shall relate an incident which came under my own observation about the time when I first went on the war-path with a muzzle-loading flint lock. A man named Daniel Hannegan, who then lived in the village of Richmond, went out one evening in the month of August, 1839, accompanied by a young man named Robert Stanley, and set a gun in a field of oats on the outskirts of the village. Having completed their arrangements, the hunters climbed to the roof of a barn in the centre of the field to await the result. Shortly before sunset the bear came in, and walked straight across the line in front of the muzzle. The gun went off and sent two one-ounce bullets through the body of the animal, a little too low, however, to drop him in his tracks. The wounded animal made slowly for the woods, followed by the men. When Hannegan, with a reserve gun, got close enough, he fired a second shot and wounded the beast again, and was advancing close up to

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him, when the bear turned and charged him with open mouth. The proverbial "fierce and angry growl" was not heard, but the attack was so sudden and unexpected that Hannegan was obliged to back up, when his heels, coming in contact with some obstruction, he fell on his back, and bruin instantly descended upon him, "tooth and nail." The infuriated animal caught one of his hands, which he had raised to defend his face, in his teeth and passed his great tusks through it in several places, and lacerated various parts of his body dreadfully with his claws. Although almost in the death struggle, the savage animal would certainly have killed his antagonist had not Stanley opportunely arrived on the scene, and quickly dispatched him with an axe. This was a very large bear; and I can vouch for the fact that it was three months before the wounded man was sufficiently recovered from his injuries to go bear-hunting.

According to Godman's "Natural History," black bears have been observed in the vicinity of Hudson's Bay, in the month of June, before the berries are ripe, feeding entirely upon water insects, which are driven into lakes and bays in prodigious quantities by gales. The animal swims along with his mouth open and gathers the insects on the surface. This species of food imparts a very disagreeable taste to the flesh of the bear, which, in my opinion, is not very agreeable under ordinary conditions, with the exception, perhaps, of the hams, when nicely cured and smoked. The hams of two large bears which I shot on the south side of Rideau street, near Nicholas street, were treated in this manner and proved excellent.

The black bear fights with teeth and claws, and by hugging, to which latter peculiarity many a good dog owes his death. When in an erect position the bear is a perfect master of the manly art of self-defence. It would puzzle a pugilist of either the light or heavyweights to get in a blow when he is in this position. The most vulnerable part of a bear is his nose, which is provided with many sensitive nerves intimately and directly connected with the brain. When a bear is standing on all fours there would be no difficulty in striking him with a club. But when he is sitting erect it would be an entirely different matter. An expert swordsman might be able to reach him with a rapid thrust; the scientific Tipperary man, with a blackthorn, never.

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The black bear is easily tamed when taken young, and, for the first six months of captivity, makes an amusing and interesting pet. As the animal increases in age and size it becomes unmanageable, treacherous, and ultimately, positively dangerous. It can then only be held safely by means of a strong collar and chain; and can be mastered and kept in subjection by the person alone who obtains the ascendency by the most violent methods of inducing docility. Bears cannot be recommended as domestic pets. More powerful, but not less treacherous, than foxes, they are far less docile and affectionate in a state of domestication than wolves.

In Canada black bears retreat to their dens—generally under the roots of large trees, or occasionally in rocky caves—in the first part of December, or a little earlier or later, as the season of confirmed frost and snow sets in. They remain there in a quiescent state, although not in a trance-like condition of torpidity—until the first or second week of the month of April, or the latter part of March if the spring is open. The facts relating to their state during the period of hibernation which I have mentioned, has been well established by hunters who have killed them in their dens in the depth of winter. I have also verified it in the case of one kept in a state of domestication. I know of nothing authentic as to whether they suck their paws in hibernation or not, although this is asserted. Some naturalists who have studied the subject carefully, have concluded that the hibernating slumber is occasioned by an increased slowness of the circulation of the blood, superinduced by the colder condition of the atmosphere during winter; and that the physical transition through which they pass, cannot be considered as a state of absolute torpor. In proof of this can be adduced the well known fact that, when attacked or wounded in their dens, they become at once wide awake and aggressive. When they first emerge from their four months' slumber, bears are heavy and fat, and their fur is in prime condition, but shortly afterwards—owing to the scarcity of food in the early spring—they fall off in flesh and soon become ragged in coat and lanky in appearance. Towards the month of October, if they have had a favourable summer, they are found in good condition, and any time after the middle of November their skins have the finest colour and the thickest and heaviest coat of fur.

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Bears are extremely fond of beechnuts. In the fall they make great havoc among the branches, where they are sometimes shot by the hunter, being then, while busily engaged in feeding, less watchful than usual. They also tear up old stumps and rotten logs in search of grubs, and larvæ of insects, and ants. Except to escape from dogs, or when in search of nuts, bears are seldom seen in trees. They will run long distances before hounds, if not attacked by them, without climbing. When overtaken by dogs they sit erect and defend themselves with great dexterity until they catch sight of the hunter, when, if not too late, they immediately continue their flight.

Black bears are very tenacious of life. A bullet must be well placed to knock them over in their tracks. After a bullet has actually passed through the heart, this animal—as is often the case with a deer—will sometimes run fifty or sixty yards before he drops. Two large bull terriers and a third dog—a cross between the bull dog and bloodhound, to do the scenting—would prove a match for the largest black bear. His pugilistic tactics, although certain to prove successful against the attack of one, would be of little avail against the onslaught of two such dogs. I have seen this tried and know the result.

Bears are still to be found within eight or ten miles of the city of Ottawa. According to authentic reports they have been quite abundant this season in the more remote and less settled districts of the Ottawa Valley. About ten years ago a bear frequented the bush on the MacKay estate, near New Edinburgh, for a number of weeks. Another was frequently seen, about the same time, during the autumn and until the time the snow set in, in the woods around Brigham's Creek, on the Quebec side of the Ottawa. I spent an afternoon following the old tracks of the latter animal, but failed to find him. About thirty years ago a large bear was killed on the Gatineau, which was about as light in colour as the Polar bear. The hair of this animal was very coarse, although the inner fur was fine. Whether this animal was a *lusus naturæ* or a solitary wanderer from the Arctic Circle, it is difficult to say. From its general appearance and anatomical structure, I am inclined to believe that it was the former, and belonged to the black species. Its appearance was as unaccountable as the white variety of the Virginian deer frequently met with in the Ottawa Valley.

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Bear skins are used in the manufacture of fur coats, sleigh robes and other useful articles, not forgetting the formidable looking head-gear of many regiments of the British army, which so often has terrified the enemies of Britain. The deep, glossy skin of the black bear renders it peculiarly beautiful, and its warmth, arising from its thick coat of fur, is highly desirable in the cold weather of our Canadian winter.

A few words in conclusion. It it is not my intention to moralize at any great length upon the want of practical adaptability so painfully apparent in much of the legislation enacted for the preservation of game and fur bearing animals, game birds and fish. To be practically useful and effective, all such laws ought to be founded upon a sound knowledge of the haunts and habits of the animals intended to be protected, without regard to sectional prejudices or mere local influences. I cannot but regret that the public mind has not yet been adequately aroused respecting the national necessity for the complete, stringent and practical protection and legal preservation of our animals. The stable will probably be locked after the steed has been stolen. This will be but a poor consolation to the coming generation which, I much fear, will have tangible cause to regret the apathy, neglect and destructiveness of to-day, which leads to the lamentable extermination of game and denudation of our forests. In an agricultural point of view, Canada would be much better off with a larger area of standing timber, and not a bit the worse of having double as many wild birds and wild animals as can now be found within its borders. Even the black bear, which is ruthlessly slaughtered in all seasons, is, in my opinion, of sufficient importance to entitle him to that degree of legal protection which he has never had. No more utterly forsaken and desolate prospect can be imagined than that of a country unwisely stripped of its forest trees, and without the wild animals and birds, which contribute so materially to the value, interest and beauty of the wilderness.

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WATER CRYSTALLIZATION EFFECTED BY MAGNETISM.

MR. E. ODLUM, M. A.

Read 29th January, 1886.

It is regretted that the funds available for the publication of this number of the Transactions do not permit of printing *in extenso* this paper (which, however, does not especially deal with local natural history), for the publishing committee has found it impossible to satisfactorily condense it, or to make an abstract that would fully and clearly present the views of the writer. He describes numerous phenomena connected with the freezing of water under different conditions, and endeavors to show that they give ample evidence of magnetic influence as a prime factor in crystallization.

MICROSCOPICAL SOIRÉE.

HELD 12TH FEBRUARY, 1886.

As a variation from the ordinary soirees, one evening of the course was set apart for the examination of microscopic objects, and it proved to be a very pleasant and instructive meeting. By invitation of Vice-President Woods, the soiree was held in the assembly rooms of the Ottawa Ladies' College, of which he is principal. A large number of microscopes and slides were loaned by the members of the Club, while several of the teachers and pupils of the college contributed to the enjoyment of the evening with music and songs. The President made a few brief remarks on the advantages which the Council hoped might result from the meeting, and announced the programme, which was opened by a piano solo by Miss Hart. Prof. Macoun then gave a brief description of vegetable tissues. The space of ten minutes was then devoted to examining slides illustrative of his remarks, the same course being

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followed with reference to the several speakers. Mr. J. F. Whiteaves described deep-sea dredging, and outlined some of the work undertaken by various governments. Specimens obtained from the Gulf of St. Lawrence and elsewhere were exhibited. Mr. F. D. Adams explained the origin and formation of lava, and showed sections obtained from various places. After a song by Miss Nellie Woods, entitled, "The Vision Beautiful," an intermission permitted those present to have a few minutes conversation, or to examine any slides which might be specially interesting to them. Miss Katie Cameron followed with a song, "Marguerite." Some magic lantern slides of blood corpuscles and other animal structures were shown by Dr. Wicksteed. Mr. J. B. Tyrrell described the forms and habits of some parasites, numerous slides of which were examined. Mr. H. M. Ami described the preparation of vegetable infusions, and some of the commoner forms found therein, which were viewed with much interest. Mr. T. C. Weston had on exhibition a collection of *Eozoon Canadense*, consisting of specimens in mass and in microscopic sections, and of photographs, which had been specially prepared to be sent to the Colonial Exhibition. Miss Denzil and Miss Cameron sang a duet, "When the Wind Bloweth in from the Sea." After a vote of thanks to Principal Woods for the use of the college rooms and to the ladies for their kind assistance, the meeting concluded with "God Save the Queen."

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A NEW DEPARTURE IN THE STUDY OF MINERALS.

REV. PROF. C. F. MARSAN, M.A., O.M.I.

Read 18th February, 1886.

It is a subject of wonder for a careful observer how few among intelligent and well educated persons devote themselves to the study of the natural sciences. The beautiful and wondrous things which God has created and scattered, with a lavish hand, in man's way attract very little of man's attention. Their superficial beauty may occasionally recreate his senses, strike his fancy, if he is anything of a poet; but the very cause of that beauty, the laws that preside over nature and unite all in one sublime harmony, too frequently escapes his notice. Among the sciences which relate to this our rich earthly inheritance, Mineralogy, the oldest by its object, yet the youngest born and latest developed in the human mind, holds a prominent place. Having for its object the very material of which this earth of ours is composed, and closely connected as it is with the all important sciences of Chemistry, Geology, Botany, Zoology and Astronomy; the industrial and economical interests which spring from it, which lingered during its infancy, grew with its growth, and yet await its final development in order to raise the material wealth of nations to its maximum, have all contributed to promote the study among the scientists of this country; but all these reasons have not been sufficient to bring the average student into close contact with the science of minerals and rocks. It would carry me beyond the limits of my plan were I to enquire into the causes of that neglect; let me point out only one cause, the consideration of which will form a natural introduction to the subject of this discussion. Mineralogy, though now raised by the immortal discoveries of Hauy, to the rank of a science with a complete system of classification, has not yet been presented to the beginner and student in a way to render it both logical and attractive. In other words, the system generally followed in teaching this science is not in keeping with the high standing of the science itself; it is defective in more than one respect. Such, at least, is the opinion which I propose to defend.

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In the first place I must say that though Mineralogy is undoubtedly one of the natural sciences; it would be taking a false view of it to compare it, so far as system and classification are concerned, to the other branches of natural history. It must be admitted that mineral species are produced in nature each according to its own character and properties and are as clearly distinguished from one another, even in external forms and structure, as the most absolutely defined species in any of the higher kingdoms of Botany and Zoology. But if the distinction is as complete, the principle of that distinction is not the same as in plants and animals. The tree which rears its lofty head in our forests, the mollusk that lives out its unknown existence in the "dark unfathomed caves of ocean," the fish that seeks its prey in the highways of the deep, the brute mammal that would seem almost to have reached the apex of created perfection, had not God given to nature a foreign king, by breathing a spiritual soul into the material body of man—all these, even man himself, are formed of matter, subject to the laws discovered by Physics and Chemistry. But in all these another principle asserts itself: Life, that mysterious power whose mighty influence is so clearly visible in the external form and internal structure of plants and minerals that it must also necessarily rule the whole of those sciences that have the higher created beings for their object. Biology, Physiology, Anatomy regulate the whole system of the Botanical and Zoological sciences, and in spite of all the progress of modern chemistry, I cannot believe that it will ever be found necessary to label any vegetable or animal species with its chemical formula or the percentage of its component elements. In Mineralogy the case is quite different. The mineral, free from the influence of life, is entirely subject to those chemical laws which hold exclusive sway over all inanimate matter. In fact, between the mineral properly so called produced by nature, and the artificial substance produced by the chemist in his laboratory, there is no specific difference. The same laws have presided over the formation of each with this difference only that in the one case the necessary conditions were fortuitously combined by natural agencies, whilst in the other they were intentionally set by the intelligent scientist. All substances, therefore, which have a definite composition, whether occurring in the rocks or artificially prepared, belong to the same

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kingdom of nature. This fact, however, does not impugn the correctness of the distinctions usually made between the natural and artificial substances or the propriety of the terms mineral and mineralogy used solely in connection with the former.

I admit the propriety of distinguishing minerals from other chemical substances; but I think it illogical to give the imaginary line of demarcation drawn between them as a sufficient reason for following a completely different method in the study of each of the groups thus delineated. It is not our arbitrary conventions, but the very nature of things, that ought to suggest the proper line of action in this as in all other studies.

I am, therefore, convinced that mineralogy cannot be independent of chemistry, and in chemistry I include even the study of crystalline character. In this extended application of the word chemistry, I follow the example of Cooke, Bendant and other far-seeing scientists, who, in spite of present difficulties and apparent contradictions, foretell a time when chemistry and crystallography, studied from a higher point of view, will infallibly lead to the same conclusion, and become, in fact, one and the same great science of the constitution of matter.

My remarks, however, in this paper will apply exclusively to Chemistry in its restricted sense, as Crystallography receives a due amount of attention in our present system of studying Mineralogy. I must here forestall an objection. My objector would say something to this effect: "You are pleading for the dependence of Mineralogy upon Chemistry, but is not this fully realized in the system now followed by almost all authors on Mineralogy?" My answer is that you are partly right and partly wrong. Most authors on Mineralogy, and, in fact, all of such as are authorities on the subject, hold that chemical composition, together with crystalline form, must be the basis of classification in Mineralogy. They follow that principle: first, in deciding whether a certain class of specimens constitutes a new species or is simply a variety of another already described species; secondly, in grouping together minerals similar in composition. This is amply sufficient to demonstrate that they accept the above mentioned principle of the dependency of Mineralogy upon Chemistry. But is that principle practically followed in such a manner as to induce the student to look to Chemistry as the

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only natural road to Mineralogy? I think not. I have frequently used the best American text-books on Mineralogy in my classes, and in my own researches, and I have arrived at my conclusions, notwithstanding the ability they display in setting forth the present methods of that study. Requesting therefore a continuance of your very kind attention whilst I explain to you the working of that system, I hope to succeed in persuading you of the necessity of making in it certain innovations.

A complete course, even of elementary Mineralogy, includes three divisions—Theoretical Mineralogy, Descriptive Mineralogy and Determinative Mineralogy. Those among my readers who have devoted an occasional leisure hour to this study are familiar with these expressions and know exactly the object of each of those departments of the science. Authors on Mineralogy do not usually treat of all the three divisions. When they do, they generally write a separate work on each. Thus the great American mineralogist and geologist, James D. Dana, has published "A Complete System of Mineralogy," including all the principles of the science and especially the mathematical intricacies of Crystallography. In another work under the same title he gives a description of all the species known. But he left to his confrere, Mr. Brush, the honor of publishing a Determinative Mineralogy. Now it is evident that a text-book intended to convey to the student an adequate idea of the science, not of course of all its details, but of its entire system and general features, must embrace the elements of all the three divisions. Give the student nothing more than Theoretical Mineralogy and unless he is a born mathematician, how can you expect him to solve the mysteries of the famous six systems, letter the planes resulting from the fiftieth successive truncation of a crystal, without ever hoping to have a tangible proof that all those fantastic figures have not been systematically devised to puzzle his poor brain, and give him a higher course of pure solid Geometry in disguise. So much for the attractiveness of the study. But, leaving that altogether aside, place in the hands of the student a long list of species more or less connected; require him to remember the crystalline form, possible structure, capricious cleavage, variable colours, doubtful lustre of every mineral. Give him no credit if he does not give its hardness and its specific gravity to

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three decimal places; lower his record if he forgets the fractions of a minute in the angle between all primary and secondary planes, the angle of refraction, of polarization, etc., etc. Now, if you succeed in obtaining that from any student, you have unearthed a prodigy; your victim has accomplished a feat equal, if not superior, in point of lively interest, to the learning of the old Greek roots, which, some say, could only have been extracted from the devil's garden; or the operation of conning an answer to a few hundred problems, without ever knowing how one of them was obtained. You have developed his bump of memory, but at the imminent risk of permanent injury to his bump of common sense. Finally, Determinative Mineralogy, if not studied in connection with the two other branches, offers no better advantage; for, though after going through a series of mechanical experiments, and then laying your hand on a mineral, you turn over a few pages of Mr. Brush and say: This is the name of my specimen, you do not know the reason of your statement. You are ignorant of this mineral's place among the various classes of mineral substances, and you approach it pretty much in the same light as a blindfolded ambassador led by the hand through the fortifications of a besieged city. Such a process may be useful to the practical mineralogist who has studied no Chemistry, and who cannot be said even to have studied Mineralogy, but you do not find in it that which should ever be the guiding star of the teacher of youth—the formation of the mind.

Chemistry is absent from the theoretical part. The principle of crystallization is expounded in such a manner as to leave the student under the impression that only natural minerals crystallize. As for the laws regulating chemical composition, they are not mentioned; nor can it be alleged that the student is supposed to have studied them before, as no allusion is ever made to that anterior knowledge. On the contrary, the mechanical manipulation necessary for the most simple experiments with acids is given in detail, but not a word written to point out the chemical reaction which takes place. In the Descriptive the same exclusiveness is maintained in all but the grouping of the mineral species. The iron ores, copper minerals, silica, are put together, but not one of the numerous tests indicated by Chemistry to detect the presence of iron, copper, or that ubiquitous silica, is

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ever referred to. Again, certain actions of a particular species with the blow-pipe, fluxes and acids, are enumerated, but they are considered as being properties inherent to the mineral, like the cartilaginous, or bony skeleton of the fishes; whereas, they ought to be mentioned as an action purely artificial, but performed in order to reveal the composition of the mineral, the sole property which is really inherent to it.

But in the books treating of Determinative Mineralogy the defect becomes shocking to everyone who regards mineralogy, not as a mechanic's trade, but as a real science, built on the most beautiful, and solid, and comprehensive principles. Principles! They have ceased to exist. You would think whilst studying descriptive mineralogy that chemistry, though much neglected, was however the basis of classification. You had seen collected in one group the minerals into which Iron enters as an element, in another group no species appeared but those that contained Calcium; but you now discover that you have been on the wrong track. All your mineralogical education has to be done over again. Pay no more attention to that chemical composition, or that crystalline form to which so much importance was attributed, at least speculatively, in the theoretical and descriptive parts. Now they vanish before external characters, and will appear again only at the very end, when all other characters will have failed to individualize the species. Fusibility is brought to the front; all minerals henceforth are divided into two classes according as they fuse with greater or less difficulty, or not at all. Be not surprised now to find together minerals which differ in every possible respect except that of fusibility. Are there two more different minerals than Bismuth and Magnetite? In composition one is the pure, well-known metal, the other the famous oxide of iron; in crystallization the former belongs to the rhombohedral system, the latter when crystallised exhibits the form of the Isometric. All their other properties are likewise at the antipodes of each other. Bismuth is exactly twice as heavy as Magnetite; its silver-white tinge contrasts strongly with the black colour of the magnetic ore; you scratch it with the finger nail, but your steel knife cannot affect the other; the one has a strong affinity for oxygen, which it absorbs rapidly under the action of heat, whilst the other, already saturated with oxygen, can only be reduced by the heat applied. I repeat again, can they be more

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different? However, look in Brush, on p. 69; you will find them there united not only in the same class, or the same group, but, as it were, in the same family, standing side by side as closely allied species. For what reason? do you ask. Because both of them are fusible. Nor must you believe that they have the same degree of fusibility; far from it. Bismuth will fall in drops in the ordinary flame of a gas jet; but Magnetite, the strongest heat to be procured by the skillful management of the blow-pipe will scarcely round its thinnest edges. Another cause has brought these two minerals together, and nothing can illustrate better the scientific poverty of that system. Though Bismuth and Magnetite are two of the most easily characterized species, having very remarkable properties of their own, no group in the division of fusible minerals could be made to comprehend them, so they were left, and had to fall together under this scientific title, "Not belonging to the foregoing divisions." Of course, if we consider that Professor Brush intended his work for the use of those who are unacquainted with chemistry, we cannot throw any blame on him, nor slight the wonderful amount of erudition necessary to compile that work; for it is evident that the author had to be himself more than ordinarily conversant with the mysteries of chemistry to bring out those tests, so ingeniously contrived that even the uninitiated may, by their use, come to practical and sure conclusions. But it is no less true that the method is worse than useless to impart to the student that method of scientific research, more precious by far than all the skill he may acquire in determining particular minerals.

Some may deduce from the foregoing remarks that I am opposed to the study of Determinative Mineralogy in an elementary course. They are mistaken. On the contrary, they will presently see, when I propose my own system, what an important place I give to the determination of minerals. In fact, one of the greatest defects I find in the present system of most of the best books is the virtual exclusion of the determinative part of the science. For, as far as my humble experience reaches, I perceive that it is impossible to give to the students any taste for the rocky science till you put specimens into their hands to analyse.

I have been so long dwelling upon the actual system and showing its shortcomings that little time is left me now to expose the system

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which I should like to introduce in its stead. But fortunately, the task will be simplified, since the same principles advocated during that long criticism must now guide us in the second part of this paper.

In my opinion, the student who intends studying Mineralogy should always follow first, at least, an elementary course of Chemistry. Theoretical Chemistry is the most necessary; next in importance comes the Descriptive, which gives him a notion of the various elements and their principal compounds; finally, if he has studied Analytical Chemistry, both qualitative and quantitative, he need not study Mineralogy—he may almost be said to know it. So, as I do not want to make my work too easy, I will suppose that he has studied very little Chemistry, or even none at all, though such a student must, of course, be a little deficient, and will never have a broad view of Mineralogy as a science.

The course should be divided into two parts: namely, Synthetical Mineralogy and Analytical Mineralogy. Here I must plead guilty to the introduction of new words into the vocabulary of the science. You must not be astonished; innovations must be very slight not to affect the language of a science, and I know of no other sufficiently comprehensive heading. But you will better judge this question by yourselves when I shall have explained the object of each of these divisions. In the Synthetical, the general principles of the science are laid down, uniting together the multiplicity of facts and details under the few laws which govern them. The Synthetical Mineralogy is itself subdivided into three parts, explaining what the crystallographic, chemical and physical properties of minerals are.

The chapter on Crystallography would be almost the same as is found now in the best text-books. I know that many students will be thankful to me for making no addition to that chapter. Yet its importance can never be too well appreciated.

The second chapter is devoted to Chemistry. The general principles of the science are laid down, but with constant reference to Mineralogy. All speculative considerations are thrown aside, whilst special attention is given to those laws which are well illustrated in the composition of minerals, chemical nomenclature, symbols and formulas, laws of combination, and especially the great law of equivalence. Stoichiometry would form the first part of the second chapter; whilst

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the principles of chemical qualitative analysis in the dry and wet way would constitute the second and more practical part. The student that would deem this short study a fitting substitute for a regular course of Chemistry would be making a mistake, yet I think it sufficient for the purpose for which it is here intended. Besides, as you shall see hereafter, the whole of the second part of our course is a continued illustration of the principles expounded in this chapter, and I do not think that a student, after having followed the whole course of Mineralogy, thus construed, would have much trouble in becoming acquainted with Inorganic Chemistry.

The third chapter devoted to the physical characters, would not differ materially from what goes under that name in our text books.

I come now to the second part—Analytical Mineralogy—and this is by far the most difficult as well as the most important part of my work. First of all, you must not accept the word *Analytical* in the same sense as we say Analytical Chemistry: In that sense it would include only the determination of minerals. The word analytical is here spoken in opposition to the word synthetical, and does not mean the analysis of minerals, but the analysis of the science. Analytical Mineralogy is therefore the application of the principles of mineralogy to every particular case. In the first part, we have seen what are the general causes and laws which prevail throughout the mineral kingdom; in the second, we examine what effects nature has produced through their agency. In this sense it includes Descriptive Mineralogy, but it comprehends also the determinative study. Indeed you remember that I condemned the other systems for separating these two branches of the science. Therefore, my description of minerals must lead directly to their determination. It is very easily said, but I should prove myself very ignorant of the subject if I thought this re-union could be as easily performed. Far from believing it, I am really of the opinion that, by using only these characters which have hitherto had the exclusive right to be called mineralogical, the scheme must be thoroughly impracticable, and you cannot find this strange, knowing that the characters which are used now to determine minerals are not at all those which guide us in their classification. Consequently, the two series must remain perfectly independent.

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But cannot this be remedied, not determination and description in every branch of Natural History in analogous studies ruled by the same laws and following the same description? Why should the method be otherwise in mineralogy? I know not, but I know that it is otherwise. The scientist who wishes to classify and describe a new mineral, always makes an analysis of it; but the mineralogist who afterwards meets that same mineral, tries to find the species to which it belongs just by the external characters and a few blowpipe tests which cannot suffice to find the species, since they were not deemed sufficient to constitute it.

Chemical composition, together with the crystalline form, is the basis of classification, therefore it ought to be also the ground for determination. But chemical composition cannot be ascertained without analysis, therefore a true chemical analysis must be the fundamental operation in determining minerals. All other observations and experiments are useful only in as much as they indicate either the composition of the mineral or the habit of the crystal.

Let us now apply this principle practically. You all know that in analytical chemistry substances are grouped according to the elements which they contain. These elements themselves are classed according to the solubility of their salts. A first series of tests leads you to one of the great classes of elements, the second points out, one by one, each of the elements that enter into the composition of the substance under examination. Now, I would distribute the different species of minerals according to the order in which a properly conducted chemical analysis would reveal them. This, of course, ought well to answer every case if we suppose in the student the time and ability for making a quantitative analysis; but such cannot ordinarily be the case, and the distinction must be maintained between the complete analysis of a mineral and its mere determination.

But when the qualitative analysis has restricted a specimen to a limited group, there is nothing to prevent us from using crystalline form and physical characters to reduce it to the last species. By so doing we re-establish the logical order which is inverted in the actual system. For it is an admitted principle that those properties which are most essential must be employed to determine the classes; less abso-

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lute though important characters decide the groups and families; and lastly, slight external differences, if nothing better remains, serve to distinguish between closely allied species.

It is not necessary, in a general view, such as that taken in this paper, to give the details of the classification. But the outlines of the plan will convey you a clearer idea of what is new in the method.

Silicates are so numerons and play such an important part in the mineral kingdom that they may be said to constitute one sub-kingdom, all other minerals being relegated to form another. Thus we have the two fundamental divisions:—the Non-Silicates and the Silicates.

In the sub-kingdom of the Non-Silicates the classification is easy whatever system is adopted. We may either adopt the classification based upon the acidic element or the one which depends upon the basic or metallic constituent of the compound.

In any case we should have, in the beginning, a table containing the analytical tests which characterise, first, the great division of Silicates; secondly, each group of the Silicate or Non-Silicate sub-kingdom. At the head of each group, the characteristic reaction of each family would be given; and finally, the characters neglected till then would point out each single species which should now be completely described.

In the division of the Non-Silicates you perceive that in most cases the analytical test leads the student infallibly to the group and the family, and very often to the very species; leaving very little to the physical and crystalline character in the work of determination.

Among the Silicates, however, the difficulty is greater. The division into Hydrous and Anhydrous cannot well be effected in every case by analysis. Furthermore, the composition, so far as the quantity of each element is concerned, is extremely variable, Here, therefore, according to the plan we have adopted, we must follow, for the determination, the method which has served to constitute the species. Disregarding then, in the work of determination, those theoretical groups based on the similarity of chemical formulas, we may proceed with the help, firstly, of chemical analysis whenever it is practically available; secondly, the crystalline characters, including cleavage; thirdly, those physical properties which are more intimately connected

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with the composition and crystalline form, specific gravity being foremost; fourthly, all the other accidents of hardness, lustre, color, &c, which, though illusory when employed in drawing the great lines of classification, become reliable means of deciding between three or four neighbouring species.

Such is the scheme which I venture to submit to your examination. I do not suppose it to be perfect in every respect, but to me it seems to avoid that great inconsistency of separating mineralogy from chemistry.

For me, this is not a mere speculative notion, but an idea which I have already begun to carry practically into effect in the course of mineralogy which I have the honor to teach in the university of our city. That idea has inspired me not only in the direction of my personal studies and in my method of teaching, but even in the material dispositions of the new chemical and mineralogical laboratory which will be opened next year to the students of the university, and I hope also to many of you gentlemen who have encouraged me, by your very flattering attention, to read to the end this dry and voluminous essay.

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OTTAWA DRAGON-FLIES.

T. J. MACLAUGHLIN.

Read 4th March, 1886.

To give anything like an accurate description of the dragon-flies, as a whole, would be rather a difficult task, and is, perhaps, more than it would be advisable to attempt at the beginning of my remarks; but before proceeding further it may be well to give a general idea of the predominant or characteristic features of the family to which they belong.

The head is generally large, in some species globular, with very large eyes often encircling the head; thorax large and square; abdomen always long, slender, cylindrical, burnished, brassy green and of various other colors; four membraneous, net veined wings, generally transparent, but often spotted and clouded, and in some cases almost entirely black, always expanded; legs long and delicate, evidently not intended for much walking.

Not long ago the Order Neuroptera was divided into two sections as follows (according to Erichson):

Section I.—Pseudo, (or false) Neuroptera, Mandibulate insects with incomplete metamorphoses (active pupa); lower lip mostly cleft; four membraneous reticulate "wings (rarely with rudimentary wings or "apterous), antennæ either subulate, and then the tarsi three—to four "—articulate, or setiform, or filiform, in which case the tarsi are two—"to four—articulate."

Section II.—True Neuroptera.

Mandibulate insects with complete metamorphoses (inactive pupa); lower lip entire; four membranaceous, more or less reticulate wings (rarely with rudimentary wings or apterous); antennæ, setiform, filiform, clavate, capitate or pectinate; tarsi five-articulate.

These sections, however, are now considered by Entomologists as entirely distinct Orders.

Pseudoneuroptera is composed of six families; Termitidæ, Embidæ, Psocidæ, Perlidæ, Ephemeridæ and Libellulidæ. To this last family

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belong all our dragon-flies, and it is divided into three tribes: Agrionina, Æschnina and Libellulina. Many of the genera are not represented in my collection, and indeed some of them are unrepresented in Canada so far as I can learn. I will not here mention all the sub-divisions of these groups—it would only be confusing—but I will notice our species as they occur in my collection.

The tribe Agrionina embraces all the smaller forms and some of the most beautiful species of the Odonata, which sub-order embraces, and is co-extensive with, the family Libellulidæ. The following description of this tribe is taken from Dr. Hagen's synopsis of the Neuroptera of North America:—"Antennæ four jointed; eyes distant; wings equal; "abdomen cylindrical, slender; accessory genital organs with the "anterior hook connate; penis and vesicle separated; genital organs of "the female vaginate."

The first sub-family is Calopteryginæ, the peculiarities of which are that the wings are densely reticulated, broad at, or toward, the apex or tip and very narrow at the base, with many antecubital veins and the pterostigma wanting in the males.

Calopteryx Maculata, Beauvois, is a very pretty insect; the upper part of the head, with the thorax and abdomen, are of a bright green or blue colour, while the under portion of the same and the legs are black. The wings, in the case of the male, are entirely dark brown, closely approaching a black, except a small portion of the base of the hind ones which is semi-transparent. The length of the body is about 1 $\frac{7}{8}$ inches; expansion of the wings 2 $\frac{3}{8}$ inches.

Calopteryx aequabilis, Say.—This insect answers to the same description as the preceeding one, except that, instead of being black, the wings are hyaline or transparent, with a broad dark band on the apex of each, which gives it a beautiful appearance when flying in the sunlight.

Calopteryx virginica, Drury.—Although not so attractive as either of those mentioned this is still a very interesting species. The wings are narrower and of greater expansion, smoked or yellowish in colour with a semi-hyaline cloud on the tips and the pterostigma is milk white.

From their erratic course, the color and comparatively slow motion of their wings, and their habit of alighting on plants, branches

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and stones every few yards they go, one not acquainted with these insects, would, without close observation, be apt to mistake them for butterflies, but when they are at rest at a reasonable distance the most casual observer would readily discern the difference. These insects frequent, and it may be said inhabit, swift running streams, especially, I think, those streams that flow through shaded places and woods. In open stretches and glades along such running waters those pretty little creatures are most likely to be found. They are not particularly rare in this vicinity but may be considered as quite local. The only place at which I have observed them is along a brooklet on the north side of the Aylmer road, which winds thro' low lands, meadows and woods from the direction of the Chelsea Hills and falls into the Ottawa River somewhere in the neighborhood of Hull.

I had been on the lookout for a representative of this genus for a whole summer without success, and not knowing the nature of their habitat, my desire to meet one of them would probably still be unsatisfied had it not happened that I accompanied Mr. Fletcher to the little creek mentioned, and there in all their lovely simplicity, fluttering about in their wonted listless fashion along the murmuring brooklet, shaded by long grass and overhanging willows, I first gazed on these little denizons of the stream. Nor did they seem the least alarmed at the approach of intruders, but continued to enjoy the silence of their secluded haunt which was only broken by the rustle of the leaves overhead and the musical babble of the waters as they rode over the shining pebbles beneath them. On this occasion we had very little trouble in securing several good specimens of each of the species named.

Sub-Family II.—Agrioninæ. The flies of this sub-family resemble those of Calopteryginæ in the general shape of the head and body, but the venation of the wings is very different, for instead of having many antecubital transverse veins they have only two. The wings also are petiolated in shape, *i. e.*, narrowed into a stem-like neck at the base, and always transparent without spots or clouds. The species are nearly always much smaller than those described, and instead of inhabiting swift running waters, most of them seem to have a decided preference for standing pools or sluggish streams. They vary in size

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from an inch to an inch and three quarters in length, according to the species, and some are perhaps smaller than this.

Of the genus Lestes, I have just two species; *L. unguiculata*, Hag., and *L. eurina*, Say. The latter is an addition to the Canadian list not having been recorded before. These insects are so closely allied to those of the following genus, Agrion—the only distinctions being a slight difference in the length of the abdomen which is in favour of Lestes, and some difference in the form and venation of the wings—that my remarks on the Agrions as regards size, habits and general aspect will apply equally to them.

Agrion putridum, Hag; *A. pollutum*, Hag; *A. durum*, Hag; *A. civile*, Hag, and *A. iners*, Hag. are the smallest insects of the Odonata. They are much alike in habits and features, and where one of these five is found there also may the rest be looked for. During the forepart of June they begin to issue from the pupæ cases, and from this date to the middle of September may be seen along the edges of creeks and small rivers, but in greater numbers where the water is standing and impure. Patterson's Creek, or that part of it between Bank street road and Elgin street, seems to be their favourite locality about Ottawa. They are very numerous here amongst the bulrushes and tall grasses which grow by the edge and in the shallow water. Upon the submerged stems and leaves of such plants they are said to deposit their eggs. I have never seen any of the agrions in what I could be sure was the act of oviposition, but I have often noticed them submerge a portion of the abdomen in the water, whether this was for the purpose of depositing eggs I know not, but I am of the opinion that no oviposition took place on any of the occasions of which I speak, as this performance was only of momentary duration. I have no doubt, however, that the eggs of these insects are committed to the water in some such manner, and perhaps the practice that I have so often observed, of dipping the abdomen into the water, was preparatory to the act of laying eggs. I have seen the statement somewhere that a certain species—*Agrion civile* I think it was—goes below the surface of the water several inches to deposit her eggs. It well repays one to remain quiet for a few minutes to watch and note the slow, noiseless and graceful movements of these little objects, a thousand of which might float

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through the air about one's ears and not a sound be heard to indicate their presence. In addition to their fragility and innocent appearance some of them are arrayed in the most exquisite and gorgeous colours, and though the wings are plain and transparent, the absence of beauty in this respect, as compared with some others of their kind, is more than made up by the distinct, varied and brilliant colours of the rest of their bodies. They show their affections for each other in the most delicate and impassionate manner; the male, with the little forceps at the extremity of his abdomen, clasps the female gently about the neck and in this way they start off on their hymeneal wanderings, in the same slow and careless manner which characterizes their movements when flying alone. After death these insects lose their brilliancy and some of the colours disapear altogether, so that dried specimens in the cabinet show to very poor advantage compared with their appearance when alive and in a natural state. On this account it would be well for the collector, who is able to do so, to make a careful drawing of the fly at the time of capture and paint in the different shades in order to study it afterwards.

Agrion Hageni, Walsh.—This is a somewhat larger species, and does not confine its peregrinations to so small an area as some others of the genus do. Keeping well on wing, it approaches more closely, in point of appetite and disposition, to the larger insects of the other tribes. The upper surface of the thorax is powdery, but the rest of the body and wings present little diversity from the others.

Agrion violaceum, Hag., is of a violet colour, nearly as large as *A. Hageni*, and very energetic, but not so strong, and is more gentle in its manners.

Tribe II.—Æschnina.—Hagen's description of this tribe, as differing from the others, is as follows:—"Wings unequal; triangles of all "the wings of the same form; genital organs of the male having the "hamule connate; the penis and vesicle conjoined; genital organs of "the female vaginated or exposed."

Sub-family III.—Gomphinæ.—Eyes distant; posterior wings broader than the anterior ones.

Gomphus exilis, Selys.—A specimen of this species was taken in Dow's swamp, two or three miles to the southward of the city; and notwithstanding that I have seen many in and about that locality, I

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have not observed one elsewhere. Is the swamp its habitat? It is a plain-looking insect; the markings of the body are dusky and inelegant; the wings are wholly transparent, with twelve antecubitals and nine postcubitals; length, about 2 inches; alar expanse, about 2½ inches.

Gomphus vastus, Walsh, is a larger species. Length of body, 2¼ inches; alar expanse, 2¾ inches. The abdomen is very stout at the base, very slender in the middle, and the last three segments are enlarged into a sort of knob, The wings have fourteen antecubitals and thirteen postcubitals. I obtained a specimen of this species from Mr. Fletcher, who informs me that myriads of the same kind were to be seen a few years ago, flying about the Parliament buildings. I have never to my knowledge seen one living. It is a very singular fact that certain species of insects may abound in vast numbers one summer and not appear again, or be very rare, in the same part of the country for years afterwards.

Æschna.—The members of this genus are the most formidable looking of our "darning-needles." Their heads are unusually large, eyes are connected from near the labrum or upper lip to the upper part of the head and cover both sides down to the jaws or mandibles. The latter are exceptionally large and powerful, and the thorax is of immense proportions. The first few segments, or base of the abdomen, are small and pedunculate, while the rest of the member is long, slender and the same size throughout; the wings are broad and strong and lack the beautiful paintings which embellish those of the libellulidæ and others. The slenderness and length of the abdomen bear such a striking contrast to the enormous size of the other parts that these insects appear to be of the most anomalous structure.

Æschna heros, Fab.—Measures about 3⅛ inches in length and a little more if the appendages are included. The wings expand about 4 inches, and have 21 to 25 antecubitals and 13 to 16 postcubitals. If the dragon-flies have fallen into ill-repute—and I think they have with some—their disgrace may well be attributed to this monster, and his brothers *Æ. verticalis*, Hag. and *Æ. vinosa*, Say, although neither is so large, may be counted in and considered as accomplices in the career of carnage and murder which has caused the degradation of the race. So far I have spoken of the beauty of the dragon-flies in terms

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of admiration, but the splendid metallic colours which go to adorn and beautify insects of ordinary modesty are apt, in these species, to be completely lost sight of in considering their ferocity and bloodthirsty nature. But in looking at these horrible creatures (as some consider them) more deliberately we find they are not so bad after all, for it is in the satisfying of the demands of their voracious appetite that the object of their existence is carried out and their benefits conferred upon man. Were it not for the untiring wing and vigilant eye of these insects, many other noxious and troublesome forms would have things too much their own way. On the alert from morning to night they wage a continuous warfare against the mosquito and other small flies, and even moths and butterflies, with their bodies distended with eggs, on their way to some suitable place of deposit, are overtaken in the lightning course of the large dragon-flies, pulled down, torn to pieces and their soft parts devoured, and thus the embryonic forms of thousands of baneful caterpillars, so injurious to vegetation, are consumed in a few mouthfuls.

The three species I have mentioned are very common in these parts and may be seen almost anywhere you go, between the first of June and the first of October, and even later in the season, flying over the water, through the woods and fields, along the roadsides, in gardens, and according to some accounts often get into kitchens, in which case they soon become "Monarchs of all they survey." They often visit unoccupied grounds near dwellings, between sunset and dusk. I have frequently watched them measure off, as it were, about 100 feet square, then, keeping well within these bounds, proceed to investigate every foot of it until dark, then put up for the night on the fence or on the side or roof of the nearest building. *Æ. verticalis* is about 2¾ inches in length; alar expanse 3¾ inches—eighteen anticubitals; fourteen postcubitals. *Æ. vinosa* is a little longer; alar expanse 3⅞ inches—twenty anticubitals; sixteen postcubitals.

Tribe III.—Libellulina. The prettiest of all the large dragon-flies are included in this division. I have noticed that writers describing the Odonata invariably select one of the Libellulæ as a typical species of the whole family, and from this standpoint proceed to depict them in every other than a flattering manner; this I consider is not fair, not

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only to the first tribe, which I have considered so beautiful and innocent, but also to those of the tribe to which the insect thus selected belongs, as they are thus made to bear more discredit than they really merit. These insects are not nearly so ugly looking nor so voracious as those of Æschnina which I have tried to justly saddle with all the dishonour and uglyness said to be due to the dragon-fly collectively. The wings of nearly all the Libellulinæ, as previously stated, are beautifully marked with clouds of various hues, and the different species can be distinguished at once from those of Æschnina which some of them almost equal in size—by the abdomen alone, which instead of being long and slender and capable of being coiled up like those of the last mentioned, is comparatively short, stout at the base and gradually tapers off to the end. The segments are all joined together closely, and when the insect moves the abdomen—which it can do to a very limited extent up and down—the whole mass moves upon the first segment like that of a butterfly, which it may be said to resemble, except that it is not covered with scales, is a little longer and more depressed or flattened.

Epithica princeps, Hag.—is a large species with broad wings; there is a large triangular basal spot on the posterior or hind wings, a streak on the base of the front ones, and a small spot near the middle of each. This is not at all a common insect in this vicinity. I obtained a specimen of this species from Mr. Fletcher, who collected it at Billings' Bridge. The wings have eight antecubitals, five postcubitals, and expand 3½ inches.

Cordulia lateralis, Burm.—is rather a common species here, in early spring, though apparently very rare in the Province of Quebec. The Rev. Abbé Provancher, an admirable authority in nearly all branches of entomology, and the only good one, I believe, in Canada on the neuroptera, to whom I am indebted for determining many of the insects in my collection—informs me that he had met with this species but once before he saw my specimen, and that was at St. Hyacinthe, P. Q. The anterior wings are narrow— the posterior ones broad with a small triangular basal spot. Length, 1¾ inches; alar expanse, 2⅜ inches; seven antecubitals, six postcubitals.

Plathemus trimaculata, DeGeer, has three dusky brown spots on each wing; the abdomen is brown with yellow spots on either side.

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Length, $1\frac{3}{4}$ inches; alar expanse, $2\frac{5}{8}$ inches. Twelve antecubitals; ten postcubitals.

Libellula quadrimaculata, Linn.—This is one of the first dragon-flies to make its appearance in Spring, and is rather common from May to July, but I have not seen many after the latter month. The wings have four brownish spots each, and are otherwise beautifully varigated with yellow stripes. Length, $1\frac{3}{4}$ inches; alar expanse, $2\frac{7}{8}$ inches; seventeen antecubitals; ten to twelve postcubitals.

Libellula pulchella, Say, is a large insect and is rather plentiful all summer; the wings are truly ornamental, each one having three brown spots which are surrounded by white clouds that glisten like glass. To see a number of these insects sporting over a pond, as they often do, is one of the prettiest sights in nature. Length, $2\frac{1}{4}$ inches; alar expanse, $3\frac{1}{2}$ inches; eighteen antecubitals; twelve to fifteen postcubitals.

Libellula basalis, Say.—This, in my estimation, is the prettiest of its genus, and is seldom met with about Ottawa. I have only one specimen, but I got a glimpse of another last summer in Stewart's bush, but could not secure it. The large basal clouds are fuscous or nearly black, and are very clearly defined. The apical portion is so transparent and fine in texture, that nothing can be seen of the wings when the insect is in flight, but the basal clouds—on this account I took the first one I saw for a black butterfly. Length, $1\frac{3}{4}$ inches; alar expanse, $3\frac{1}{4}$ inches; sixteen antecubitals; fourteen postcubitals. There is a narrow brown stripe all along the upper part of the abdomen and the sides are speckled.

Diplax.—The insects of this genus are the smallest of the Libellulidæ. They vary in length from about $1\frac{1}{8}$ to $1\frac{1}{2}$ inches. The wings expand from $1\frac{3}{4}$ to $2\frac{1}{2}$ inches, and have from seven to eight anti-cubitals, and six to eight postcubitals.

Diplax rubicundula, Say, is the red dragon-fly that is so common during the whole summer. The body is of a dull red, and the wings in the males are sometimes faintly tinted with the same colour. The female is of a dusky yellow, her wings are hyaline and extremely delicate. They are fond of grain fields—especially buckwheat when in blossom—where they congregate in thousands, and they probably do a

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great amount of good in devouring insects injurious to the different crops. This is a question worthy of investigation by our Dominion Entomologist if he has not already examined it.

Diplax Scotica, Don., is less common, though not rare; it seems to be a hardy species. I caught one in Stewarton on the first of November, when the weather was so cold that no other insects were to be seen, at least flying about. The wings are plain and the body black.

Diplax Hudsonica, Selys, is much the same as *D. Scotia*. The abdomen, however, is not of the same shape, and has a yellowish spot on the fifth segment; besides, it has a very conspicuous white mouth.

Diplax costifera, Uhler.—Abbé Provancher says this is the first one of this species he has ever seen. I am not positive whether I got it at Casselman, on the Canada Atlantic Railway, or at Stewarton, but am under the impression it was at the latter place, in a meadow near Patterson's creek. I visited the same locality frequently during the past summer for the purpose of securing another, but could not see one. The specimen I have is so mutilated that it is impossible to ascertain whether it is a male or a female. It somewhat resembles the female of *Diplax rubicundula*, except that there is a yellow line on the anterior margin of each wing, extending from the pterostigma to the base.

Diplax semicincta, Say, is also rather rare around Ottawa. I captured one at Casselman, on the line of the C. A. Ry., summer before last, and I saw another the same year, in the vicinity of Hull, but did not secure it, and have not seen one since. Mr. Fletcher captnred a pair of this species on the Aylmer road, on the 20th Aug. last. It is smaller than any of the Diplax described, and the basal half of the wings is clouded a sort of rust colour.

I have now mentioned all of the insects of the Odonata in my collection, but a few more are still in Abbé Provancher's possession awaiting determination. As very little attention has been given to this family, it is safe to say that many more of the species mentioned from Quebec, and perhaps others not included in the Abbé's list, will be found here; and perhaps, some altogether new to science. It would, at least, be reasonable to expect this, in view of the many discoveries entirely new to science made by Mr. Harrington and Mr. Guignard in connec-

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tion with the Hymenoptera, which order is now receiving their attention. Some of the members of the club having signified their intention of working up the Neuroptera during the ensuing summer, we may look forward to a much greater exhibit in this interesting branch of Entomology by the close of next collecting season.

Having viewed these creatures in their perfect state, we will now take a look at their early life. Dragon-flies are wholly aquatic animals, and are carnivorous in all the stages of their existence. The parent dragon-fly lays her eggs in the water, and her progeny, in their larval and pupa states, live beneath the water, and subsist upon other aquatic forms of animal life—largely upon the larvæ of the mosquito. The young of some species, after extension from the eggs, look like small spiders, so long are their legs compared with the diminutive size of their bodies.

I tried to rear some of the larvæ of Diplax and Agrion in aquaria last winter, for the purpose of gaining some knowledge of their early habits, but I do not know whether it was for want of knowledge of their proper treatment, or because of too much care, that they did not do well; at any rate, they died off shortly after confinement. Those of Diplax never seemed possessed of much vitality, and would not stir unless when touched, and then but very little. But the Agrions were all active and of a remarkably sportive turn, continually swimming up to the surface of the water, and when this point was reached they would suspend all muscular exertion and sink slowly to the bottom, often two or three lying across each other.

They would sometimes nibble at small pieces of meat which I offered them, but notwithstanding that I changed the water often and gave them all the other care I thought necessary, they grew weaker every day, discontinued their accustomed exercises, and finally passed quietly away, one after another, in the course of ten or twelve days after capture. I placed a few other Agrions in a separate vessel and put with them a bunch of lemna and moss in which I had found them imbedded in the water. I did not change the water in this bottle, nor did I give them any other attention, and left them in a cooler and darker place. This seemed better treatment than the other, for although these insects refused to eat anything, they survived the others three or four weeks.

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The pupæ of the dragon-fly are only distinguishable from the larvæ by having wing-pads on the back; both being equally active. When the pupæ are ready for transformation they crawl out of the water upon the stems and branches of plants, secure a firm hold and remain until the sun dries the skin, which splits on the back, and the perfect insect comes forth, and leaves the hull clinging to the plant. Many of these old hulls or pupæ-cases may be seen sticking firmly to reeds and grasses along the edges of ponds, etc. After coming from this case a very short time is required to expand and dry the wings and otherwise prepare the insect for its ærial home, then away goes this beautiful creature with gauzy wings of gaudy colours, which, but a few moments before was a horrible, repulsive and voracious object, crawling over the slimy bottom of a filthy pool of stagnant water.

These insects have a remarkable weapon which enables them to capture their prey in their larval and pupa states, with as much ease as they afterward can upon the wing. The lower-lip is very long and shaped like a ladle, the end terminating with two incurved hooks. When the animal is at rest this elongation of the lip is folded up and concealed beneath the under jaw until some luckless insect comes within striking distance when out slips this trap-like apparatus (against which its victim has made no provision) and secures the booty.

With regard to their manner of breathing, Duncan in his work on the "Transformations of Insects" says: "The larvæ and nymphs "although living under water and must respire, have no branched or "external organs by which they can breathe. Their method of respi-"ration is unique; they breathe with their intestines. The large "intestine is covered with numerous tracheæ, and when the animal "wishes to breathe, it opens the orifice of the intestine and admits a "quantity of water. This of course contains air mechanically "suspended which is taken up by the tracheæ just mentioned." In expelling the water thus taken into the intestine it is sent out with considerable force which propels the animal forward with a jerk several times the length of its own body, and by this means it keeps out of the way of its enemies.

Dragon-flies always attract, more or less, the attention of everyone, and often excite curiosity in many who take but little notice of

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insects generally. Some people notice them in order to avoid them on account of the mistaken impression which seems to prevail as to the poisonous effect of their sting, or on account of the childish tradition as to their habit of sewing up the eyes and then stinging their victim to death; while others admire them for their beautiful colours, slender forms and graceful motions. They are known by various names and epithets, such as:—Devil's darning needles, Mosquito Hawks, Horse-stingers, and some others in English. The Germans call them Wasser-jung-fern, or Virgins of the water. The Indians know them by the name of Kow-ne-she, or Duch-kow-ne-she, and the French are pleased to style them Damoiselles. This last does not seem so appropriate as some of the other appellations, as the point in which any of these creatures resembles a lady is not clearly defined—unless it is in their slender waists. I know that some of the large ants are also called Damoiselles by the French, and their delicate forms rather suggest the name; but with all their admiration for the beauty and modesty of women, I agree with Duncan when he says:—"No Frenchman would "think of comparing a dragon-fly to a lady if the nature of this animal "was known."

Avoided and despised as the dragon-flies are by many, I need scarcely say in conclusion that they are the most harmless things in creation—utterly incapable of injuring man or beast, but on the contrary, are highly beneficial in every form and in every stage of their life.

It is much to be regretted that the minds of children are often wrongly impressed by the telling of fabulous tales, and otherwise, regarding many objects of nature, which proves a stumbling block in the way of truth and science in after years.

If children were taken to the fields and to the woods at the earliest possible time, when the young mind is blank, so to speak, and susceptible of every impression, whether for right or wrong, and taught to observe and love the surrounding objects of nature; to avoid these things which ought to be avoided, but at the same time to admire and respect them; to know that a portion of the economy of the universe is laid out for each and every creature, and in order that its appointed task may be fulfilled with the greatest ease, each one is given the form and features peculiar to itself and most adapted to its calling; that the innumerable

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works of creation all harmonize together for the one good purpose of humanity, and that therefore everything employed by nature, from the smallest to the greatest, irrespective of its appearance or the duties it has to perform, is worthy of man's greatest respect, his study and his intellect. By pursuing such a course in the early education of our children, we would be doing as much, I think, for the advancement of the natural sciences as we could otherwise hope to do.

REPORT OF THE GEOLOGICAL BRANCH.

PALÆONTOLOGY AND STRATIGRAPHY.

To the Council of the Ottawa Field Naturalists' Club.

The undersigned Leaders of the Geological Branch have much pleasure in presenting you with their report, (on palæontology and stratigraphy) and beg leave to state that as years go by there is a marked increase in the interest taken in geological work about Ottawa —a field so rich and varied for the lovers of that attractive science.

During the season that is just passed, the leaders appointed by your council have availed themselves of every opportunity possible to further the ends which the club has in view, and have performed the duties entrusted to them with the utmost diligence. As many sub-excursions as practicable were held, especially in the latter part of the season, and in various directions about the city, so that quite a number of new facts were gathered and most of the formations exposed in the neighbourhood visited. No less than *fourteen* excursions and sub-excursions were held, and the attendance at these far surpassed that of any previous season in the history of the club.

As in former reports of this nature it is deemed advisable to classify the results obtained under the respective formations to which they belong, so that should a general report or synopsis of the geology of Ottawa ever be compiled, the material at the disposal of the writer

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will be in a more accessible and systematic form than it would otherwise be.

Whilst, during the past season, older formations than the Chazy have been visited, it is not deemed expedient as yet to publish the notes recorded, hence this report will begin with the

CHAZY FORMATION.—This Cambro-Silurian or Ordovician formation, so extensively developed in the Ottawa Valley, and from which only a very limited number of organic forms have as yet been obtained, will in any careful and attentive examination of the various series of strata which comprise its measures amply repay the observer. In the report for 1883-84 reference is made to the lower measures of this formation, which were observed on the occasion of the Club's excursion to Lake Deschenes. The exposures referred to along the north shore of the Ottawa River at that place, and between it and the railway track, were pointed out as being almost destitute of fossils, that the only fossiliferous rocks observed consisted of a band of ferruginous and rusty weathering sandstone, two or three inches in thickness—some four feet above low water mark. From this a number of characteristic fossils of the Chazy formation had been collected. (Trans. O.F.N.C., vol. I, No. 4, p. 64.)

During the past season, Mr. W. E. T. Sowter has traced this same band in its westerly extension to the town of Aylmer, four miles from Deschenes Village, whilst the occurrence of the same band between these two localities has also been ascertained by the same gentleman. At the wharf in Aylmer this characteristic band may be seen about a foot and a-half above the lake level.

This affords, therefore, a good criterion from which to ascertain the precise horizon of the measures at Aylmer and wherever its occurrence may be signalled. A brachiopod—*Orthis imperator*, Billings—is the most abundant and most easily recognised form, so that on account of its prevalence this band will in future be referred to as marking the zone of Orthis imperator.

There is a small *Rhynchonella* associated with the above species. It has few plications or costæ but they are comparatively large and angular, much like *R. orientalis*, Billings, described from the Mingan Islands. The forms under consideration agree very well with Hall's description and

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figures *Rhynchonella plena*, or as he called it: *Atrypa plena*. These fossils along with other species are obtained as casts of the interior of the shell, &c., and are imbedded in and composed of a coarse matrix, consisting of rounded grains of quartz cemented together by a calcareous mass of a light gray colour. This band has, no doubt, a much greater geographical distribution than has as yet been assigned to it, for south, west and north of the wharf the same measures are seen along the Ottawa, on both sides of the river almost up to the Chats Falls. This discovery of Mr. Sowter's is interesting and throws additional light on the lower measures of the Chazy formation, any of which is most welcome.

At Britannia, opposite Deschenes, on the Ontario side of the Ottawa River, the club held one of its regular monthly excursions on the 19th of September last. There the same formation is again seen to crop out between the track (C.P.R.) and the river and the lake shore, as also south of the track, between it and the Richmond Road. A number of sections were taken, and the calcareous nature of many strata noted, but little was found in the way of fossils until late in the day.

From the thin bedded renaceous beds of the Chazy formation here (lower series) we are pleased to record the discovery of beautiful scolithoid markings. It was Miss Wyndham who had the honour of discovering the same, and in great abundance, in a field a few hundred yards to the south west of the present station or railway crossing. The question arose as to whether or not the presence of this *Scolithus* did not indicate that these rocks were of the Potsdam formation. Against this view was the fact, brought up by one of the leaders, that similar markings of annelids (?) doubtfully referable to *S. Canadensis*, Billings, but difficult to differentiate, had been found by him in exposures of the Chazy at Hog's Back, Nepean, between the zone of *Lingula Belli* and the "Leperditia band" higher up in the section. Then the fact that there is no evidence whatever of a fault or dislocation occurring here between Britannia and Deschenes, coupled with the horizontality of the measures throughout, makes it clear that the Chazy of Deschenes occurs also at Britannia. Thus, from the palæontologic as well as from the statigraphic argument the evidence is entirely for the Chazy formation.

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These peculiar remains of organisms—worm-like burrows—referable to Haldeman's genus *Scolithus* occur in great abundance and differ in respect but little from Billing's *S. Canadensis.* On the whole the burrows might be described as much less flexuous, less wide, rather crowded and straightened than those of *S. Canadensis,* but scarcely can it be recognised as a new species, so great is the range of variation in the specimens examined.

Chartrand's Island in Lake Deschenes—the property of Mr. C. M. Church—was noticed by Mr. Sowter to consist of limestones which for the most part exhibit the peculiar concentric patches resembling *Stromatocerium* of Hall, and is therefore of Chazy age.

Black River Formation. This formation which immediately and conformably overlies the Chazy formation has been further noticed by Mr. Sowter to be developed on the property of Mr. Neil about one mile north of the town of Aylmer, at which place the typical coral *Tetradium fibratum,* Safford, was collected by him during the past season, and indicates with great exactness that the rocks from which it came belong to this formation. A sub excursion of the club was held at the Petite Chaudière, on the Ottawa River, a favourite resort of the late Mr. E. Billings, and amongst the characteristic fossils of that formation which were collected and noted, on that day Mr. Whiteaves obtained a Cyrtoceras, probably the *C. regulare* of Billings.

Trenton Formation.—In this formation some interesting and new facts have to be placed on record. At the sub-excursion held Saturday, October 24th, in the vicinity of McKay's Bay, where the members present had an oportunity of examining a geological *fault* and upturned strata, no less than twenty-six species of fossils were collected. Prof. Macoun obtained a fine rolled up example of *Calymene senaria,* Conrad. Mr. Ami collected in addition to other interesting forms two glabellæ of *Remopleurides Canadensis,* Billings. This species described by Mr. Billings in his "Palæozoic Fossils," vol. I, p. 182, from the Chazy formation in the front concession of the township of Clarence, on the Ottawa River, had never before been found in strata so high up in the series. This together with *Remopleurides striatulus,* Walcott, were the only two species of that genus known so high up and both of the Trenton formation. Associated with this addition to

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our list of Trenton forms were found numerous specimens of *Beyrichia*, *Pholidops* and also *Orthis insculpta*, *O. pectinella* and *O. occidentalis*. *Rhynchonella recurvirostra*, Hall, oftimes referred to as a *Zygospira*, but recently placed under the new genus *Anazyga* of the late lamented Dr. Davidson, was found in very great abundance. *Dalmanites Bebryx* of Billings was also found here.

The form referred to by Mr. Ami in his "List of the Cambro-Silurian fossils of Ottawa, etc.," 1884, as *Tetradium Peachii, var Canadense*, Foord, with a query (?) has since been thoroughly worked up and examined with great accuracy by Prof. W. B. Dwight of Vassar College, Poughkeepsie, N. Y. In the course of this very interesting study, Mr. Ami had ample opportunity for nearly two years (since the spring of 1883) of seeing the whole process of elucidation, as it was developed in that well defined and eminently interesting organism. After careful examination it was definitely ascertained that the species in question was unmistakably that which Mr. E. Billings had described as *Stromatopora compacta* (Pal. Foss. Vol. I, p. 55) and the same which Sir William Dawson very appropriately placed provisionally in the genus *Chætetes*. During his visit to Europe last fall, Mr. Ami made it a point to consult Dr. Dybowski's work on "*Die Chætetiden*," etc., where that Russian author had described a form, *Solenopora spongioides* of undoubted affinity and intimate likeness to Billings' *Stromatopora compacta*. They were, no doubt, both referable to one species and one specific designation. It was then a question which had the priority, Billings', Dybowski's, Nicholson and Etheridge's or Mr. Foord's. Mr. Billings' name was prior by several years, and therefore his specific reference will stand whilst the others fall to the ground. The genus *Solenopora*, however, which Dr. Dybowski had at the same time created to receive his species *S. spongioides* will certainly stand and be accepted as the recognised genus to which Billings' species must be referred. This form then will be known as *Solenopora compacta*, Billings. The greatest difficulty which had arisen was regarding the existence of tabulæ proper. Some authors found the tabulæ to be absent altogether (Dybowski and Foord), others very numerous (Dawson, Nicholson and Etheridge), but to Dr. W. B. Dwight is certainly due the credit of discovering them in the winter of 1884-5 in especially fine and well pre-

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pared sections, some of which that gentleman very kindly presented to Mr. Ami.

Several sub-excursions were held at which the Trenton formation was examined, and at one of these, the excavations being carried on beside the Water Works office, a fine specimen of *Pleurocystites filitextus*, Billings, was obtained, and close to it a species of *Cyclocystoides*.

UTICA FORMATION.—Early in the spring (1885) Mr. Ami had an opportunity of visiting the exposures of this formation in company with Prof. C. D. Walcott, Palæontologist to the Geological Survey of the United States, whose writings on the "*Utica*" are so well known that mere mention is necessary to associate the two. On this occasion, as usual, a large number of forms were found, so that Prof. Walcott was enabled to examine a number of species regarding which it was desirable to obtain his opinion. For instance, the graptolite described by himself under the name of *Graptolithus annectans*—a form most probably referable to the genus *Leptograptus*—was collected and recognised by him. The brachiopod at times referred to *Orthis testudinaria*, Dalman, and again to some other species, proved to be *Zygospira modesta*, Say.

A Pholidops was also collected here, and numerous specimens of *Triarthrus spinosus*, Billings, with three spines on the posterior thoracic segments, together with *T. Becki*, Greene, adult and young, and other species.

Siphonotreta Scotica, Davidson, is a form which was described by Mr. Whiteaves as occurring in this formation, but nothing further was known than that the specimens had been collected from rocks of supposed Utica age about the property of Mr. J. W. H. Watts, loose, or from some excavation in the neighbourhood. Having ascertained the association of species and the lithological character of the rock in which the species was found, Mr. Ami proceeded in company with Mr. Fred Hayter, an active worker in geology, to the Gloucester side of the Little Rapids, near the rifle range, on the Rideau river, as the rocks of that locality bore a strong resemblance to those holding the *Siphonotretæ* collected up to date. The first band examined was that holding the *Conularia* in abundance; a bed of impure limestone teeming with remains of this pteropod and brachiopods belonging to the genera Zygospira, Orthis and Leptena. *Discina Pelopea* was also found here, but no trace of

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Siphonotreta Scotica was seen in this bed, which averages about an inch in thickness. The bed immediately underlying this band—the zone of *Conularia Trentonensis*, Hall—was then examined, and it was not long before several fine individuals were found of the form referred to Dr. Davidson's species. This bed is some twelve inches in thickness, and consists of a dark, somewhat bituminous, impure limestone, holding *Siphonotreta Scotica*, Davidson; *Lingula elongata*, Hall; *Asaphus Canadensis*, Chapman; *Calymene senoria*, Conrad; *Leptæna sericea*, Sowerby, etc.

As will be seen by comparing the lists of fossils already published by the club, *Lingula elongata* and *Discina Pelopea*, are both forms new to the Utica formation, and to the lower portion or oldest measures the same.

Post-Tertiary.—Owing to the activity on the part of our worthy City Engineer, Mr. Robert Surtees, C. E., and our civic authorities, in carrying on extensive sewage and other works, the student of Geology has had a great many openings and sections exposed in the Post Tertiary strata of Ottawa. On Rideau and Cumberland streets interesting sections were obtained in some places to a depth of sixteen feet. The following is one of the sections taken on Cumberland street, corner Daly avenue:—

No. 1.	Light yellow sand	2 ft.	0 in.
2.	Small rounded pebbles and sand	0	4
3.	Yellowish grey sand	10	0
4.	Bluish grey sands (fossiliferous)	2	0
5.	Stiff blue clay "	2 to 3	0
		16 ft. 4 in. / 17 ft. 4 in.	

In Nos. 1, 2 and 3 no fossils were found, but in 4 and 5 the following species occurred:—

In No. 4 ..... (a) *Notica affinis*, Gmelin. (b) *Saxicava rugosa*, Linnæus. (c) *Portlandia arctica*, Gray.

In No. 5 ..... (a) *Saxicava rugosa*, Linnæus. (b) *Portlandia arctica*, Gray.

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These shells are all of marine origin, and belong to the two classes of Gasteropoda and Lamellibranchiata. They belong to species still existing in our Canadian waters, in the Gulf of St. Lawrence, along the Atlantic coast, also in Greenland and Norway, and in other parts of the world. One of them, *Saxicava rugosa*, L., is even found on the Pacific slope, both living and fossil (Dr.G. M. Dawson). *Macoma calcaria*, Chemnitz, was also found in the Cumberland-street excavation in stratum No. 5, at a subsequent time. This species and *Notica affinis*, Gmelin, are new to the list of Post Tertiary forms published by the club (1884).

In conclusion, the Leaders beg leave to solicit the co-operation of as many of the members interested in geology as possible in collecting the material necessary to frame up a systematic work on the Geology of Ottawa. It may take years and years of labour; every little helps Facts are what we need at present, and when a good topographical map of the district has been published, it will be easier to lay down the geological boundaries than at present.

The increased attendance at the sub-excursions is very encouraging and most gratifying to the leaders, and they sincerely hope that the manifest interest taken in geological matters during the past season will be kept up in years to come.

HENRY M. AMI,
W. E. T. SOWTER,
Leaders.

29th January, 1886.

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REPORT OF THE CONCHOLOGICAL BRANCH.

To the Council of the Ottawo Field Naturalists Club:

In presenting the report of the Conchological Branch, we have to say, with regret, that but little work has been done in this department during the past year. The absence from Ottawa, during the greater part of the summer, of one of the leaders of this branch, and the business engagements of the other, may lead you to regard with indulgence our seeming neglect of duty. We have not, however, been altogether remiss in fulfilling our obligations. To act in concert with other members of the Club was, in many cases, impracticable; but whenever the occasion presented itself for individual work, it was eagerly made use of.

On the 17th May, near the High Rock Apatite Mines, on the River Lievre, a variety of the common white lipped snail, *Mesodon albolabris* var. *dentata*, was found which is of considerable interest, as throwing light on an anomolous and hitherto unsatisfactorily explained record of "Helix exoleta Binney," from the valley of the neighboring river, the Rouge (D'Urban, Can. Nat. & Geol., 1860, p. 81). In a paper read before the club on the 7th February, 1885, this record was doubted, and it was suggested, as the only explanation which seemed possible, that D'Urban's shell was really *M. Dentiferus*. Quite recently it was noticed by one of the leaders of this branch that Mr. Whiteaves had expressed the same doubt and made the same suggestion in the *Canadian Naturalist* for 1863. No toothed mesodons but *sayii* and *dentiferus* were known to occur in eastern Canada; and as *M. sayii* was enumerated in the list of shells collected in the Rouge valley, *M. dentiferus* seemed the only shell which could have been taken for *M. exoletus*. There remained, however, the difficulty of explaining how Mr. Binney, who identified D'Urban's shells, could confound species which differ so widely as *M. exoletus* and *M. dentiferus*. But the dentate variety of *M. albolabris* might readily be taken for *M. exoletus*. The occurrence of this well marked variety at the High Rock Mines thus clears up a doubtful though, perhaps, not very important, point in Canadian Natural History.

It is of interest from another point of view, as it extends the range of the *var. dentata* very materially. It occurs in Michigan, from which

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fine specimens are now in the possession of one of the leaders of this branch. Dr. Binney writes that he is unaware of it being found east of the Alleghany Mountains of Pennsylvania. Among hundreds of specimens of *M. albolabris* collected in the vicinity of this city and of Toronto, not a toothed shell has been noticed. If by "Mesodon albolabris var. dentifera, Binney," recorded in Trans. No. 5, p. 81, from the marl beds at Hemlock Lake, is meant var. *dentata*, then this variety was not long since to be found near Ottawa, as the shell marl is entirely fluviatile in its origin, and all land shells found in it are recent.

A second addition to the lists previously published has been made in the rare and beautiful *Sphaerium rosaceum, Prime.* This was found on the muddy shores of the eastern end of McGoey's Lake, in the Laurentides, near Chelsea. Had time permitted a great many specimens might be obtained from this most fruitful collecting ground. Large and fine examples of *Sphaerium sulcatum* were also found in the same locality, which affords, in addition, the beautiful *Physa Lordi* and *Limnæa megasoma.*

On the Club excursion to Britannia a number of shells were collected, but, so far as we are aware, they do not call for any particular observations.

F. R. LATCHFORD,
P. S. POIRIER,
Leaders.

4th March, 1886.

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REPORT OF THE ENTOMOLOGICAL BRANCH.

To the Council of the Ottawa Field Naturalists' Club:

During the past season considerable activity has been displayed by the members of the club connected with this branch.

Owing to the character of the weather, during the summer months, being exceptionally cold and wet, insects, generally, were less abundant than in the two preceding years. However, not a few rare species were captured, and many additions were made to the lists in the different orders. Some of these prizes, it may be added, were captured by collectors who had only taken up the study of entomology last spring. It is thus shown that valuable results may attend even the earliest efforts of any student. We are glad to welcome, as having attached themselves to this branch, some of the younger members of the club, and we trust that they will continue to prosecute the study of our local insects with the same energy as has been displayed by them this year.

The sub-excursions, which have been so successful this season, were well attended and afforded frequent opportunities for the entomologists to meet each other, and mutually profit by the exchange of ideas and comparison of observations. At these excursions also several of the best captures of the year were secured.

Attention must be drawn to a few items of general interest to this branch. Of great importance to Canadian naturalists is the fact that the Abbé Provancher, one of the corresponding members of the club, has been able to resume the publication of his useful magazine, *Le Naturaliste Canadien*, which has appeared in an enlarged form, and of which several parts have already been issued. Of special interest to the members of this branch is the recent purchase by the Government of the magnificent entomological collection of Captain Geddes, of Toronto. This is now being arranged for exhibition in the museum of the Geological and Natural History Survey, where the cabinets will soon be available for examination and reference.

The adoption of the electric light, as a means of illuminating the city, has been attended with interesting results to entomologists.

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Several species, hitherto considered rare, have been collected at these lights, to which insects of all kinds are attracted in large nnmbers.

HYMENOPTERA.—Large collections were made in this order during the season, and so many species have now been secured that the publication of a local list will soon be advisable; this, however, cannot be accomplished until a number of species collected in this locality by Mr. Harrington and Mr. Guignard, which are entirely new to science, have been described. These are now, with this object, in the hands of the Abbé Provancher, an eminent authority, who has already commenced the publication of additions to the Canadian list. Particular attention may be drawn to a few species. A curious representative of the ant family belonging to the genus amblyopone, hitherto unknown in America and only recorded from tropical regions, is represented by two specimens in the collection of Mr. Harrington. Mr. Guignard has been fortunate enough to collect specimens of a bee for which even a new genus must be created, and this step has also been found necessary for some other of the new species.

LEPIDOPTERA.—In this attractive order a considerable amount of work has been done, both in collecting and in breeding from the egg. It will be seen by the programme that a paper on the Diurnal Lepidoptera is to be read later in the winter, in which all items of interest regarding these forms will be recorded. Butterflies and moths of all kinds were remarkably scarce during the whole summer, with the sole exception of *Danais Archippus*, or "Milk-weed Butterfly," which seemed to take the place in numbers of *Pyrameis Cardui*, "The Thistle Butterfly," or "Painted Lady," which swarmed the year before, when, strangely enough, the Milk-weed Butterfly was very scarce. One of the most interesting observations made in this order during the season was an attack on the maples, and subsequently on the beech trees, in Beechwood, by the caterpillars of the small moth, *Incurvaria acerifoliella*, the "Maple leaf cutter." The larva forms for itself a flat case, in which it lives, of oval pieces cut from the maple leaves upon which it feeds. The trees for a space of several acres were severely attacked and the foliage had the appearance of having been blighted and turned brown. The case-bearing larvæ were to be seen in myriads in every direction, on the leaves, on the ground and on the stems of trees. The

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moth from this species does not emerge until the following June, so that any one desiring to secure specimens will probably have no difficulty in doing so next year by visiting Beechwood in that month.

DIPTERA.—The study of this order in Canada is still exceedingly difficult, owing to the lack of works dealing with the classification and identification of species. This, however, will be gradually remedied, as several American entomologists are engaged in the work, and articles are appearing from time to time on various groups. Specimens have been taken by several of our collectors, and the species in their possession are now fairly numerous, although but few of them have been, as yet, identified.

COLEOPTERA.—Although this order has been well investigated in past years, it has been found possible to add quite a number of species to the extensive lists already existing, while additional specimens of some of the rarer species have been captured. Among these may be noticed *Xyloryctes satyrus*, a very large beetle belonging to the Scarabæidæ, of which a fine specimen was taken by Miss I. Grant, at a sub-excursion to Beechwood in September. A fine male of *Pityobius anguinus*, figured in Transactions No. 1 under its synonym *P. Billingsii*, was captured by Mr. Fletcher in his study one evening, it having been attracted by the lamp. *Pœcilinota cyanipes*, a beautiful Buprestian, was captured at a sub-excursion beyond Stewarton, on a poplar stump. *Hydrophilus triangularis*, one of our largest water beetles, not before captured by our members, was received from Mr. A. L. Jarvis, who found it beneath an electric light. As soon as the species which remain to be identified have been determined, a supplementary list will be prepared for publication.

HEMIPTERA.—This order has not yet received much attention, but as synoptic tables are now being published in Entomologica Americana, and as Abbé Provancher is publishing descriptions of all Canadian species, it will be possible for collectors to work at it advantageously. The number of species known from this locality is, however, nearly 100.

NEUROPTERA.—Mr. T. J. Maclaughlin has made extensive collections in this order and part of his work will be submitted to the Club later, in the shape of a paper on the dragon-flies of this locality.

JAMES FLETCHER,
T. J. MACLAUGHLIN,
Leaders.

10th December, 1886.

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REPORT OF THE ORNITHOLOGICAL BRANCH FOR THE YEAR 1885-86.

To the Council of the Ottawa Field-Naturalists' Club:

Although we cannot make as brilliant a showing in the present report as we did in that for last year, yet much valuable work has been accomplished, especially in the noting of the times of arrival and departure of an increased number of species. Only four new species have been added to our local list, as against nine added last year; still this may be taken to bear witness rather to the thoroughness of the work during former years than to any lack of it during the year just past. Yet, there must, unquestionably, remain a large number of species still undiscovered, the presence of which it must be the duty of local Ornithologists in coming seasons to detect and record.

The following are the four newly recorded species above referred to. The numbers refer to the new A. O. U. Check List, from which the nomenclature is taken:

47. *Larus marinus.* Great Black-Backed Gull. One individual of this gull was seen on May 2nd, 1885, near Kettle Island, on the Ottawa, in company with ten or twelve herring gulls.

70. *Sterna hirundo.* Common Tern. A male bird of this species was shot near the St. Louis Dam on June 29th, 1885.

238. *Tringa maritima.* Purple Sandpiper. Shot on the bank of the Rideau River on October 29th, 1885, by Mr. W. Forbes.

646. *Helminthophila celata.* Orange-Crowned Warbler. A male bird of this warbler was obtained near the eastern end of the city on September 27th, 1885, by Master Ted. White.

The following are among the more important captures made during the year:

60. *Larus philadelphia.* Bonaparte's Gull. Specimens of this gull were obtained on June 9th and September 17th, 1885.

135. *Anas strepera.* Gadwall. A female of this species, rare with us, was shot on the Ottawa, from a small flock, October 29th.

202. *Nycticorax nycticorax nævius.* Black-crowned Night Heron. A specimen obtainod on October 2nd.

239. *Tringa maculata.* Pectoral Sandpiper. September 20th.

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243. *Tringa alpina pacifica.* Red-backed Sandpiper, October 2nd.

347. *Archibuteo lagopus sancti-johannis.* American Rough-legged Hawk. November 12th.

463. *Empidonax flaviventris.* Yellow-bellied Flycatcher. May 25th.

626. *Vireo philadelphicus.* Philadelphia Vireo. August 27th.

629. *Vireo solitarius.* Blue-headed Vireo. September 13th.

650. *Dendroica tigrina.* Cape May Warbler. June 7th.

660. *Dendroica castanea.* Bay-breasted Warbler. These warblers appeared rather commoner than usual last spring.

671. *Dendroica vigorsii.* Pine Warbler. August 27th.

675. *Seiurus nove-boracensis.* Water-Thrush. May 11th.

726. *Certhia familiaris americana.* Brown Creeper. There have been two more winter records of this bird, viz., February 18th and December 5th, 1885.

On the 2nd of May last Master Ted White shot a very peculiarly marked Robin. The back was ash or light gray and there were light gray markings on the tail, the latter making the bird appear as if it had a dead leaf lying on its tail.

The present winter (1885-86) has been remarkable for the scarcity of winter birds. With the exception of a number of Red Cross-bills and a few Great Northern Shrikes, none of our familiar winter visitors from the North have been noted; while Crows have been unusually abundant, having been about every day or two since the beginning of the winter. The Purple Finch (*Carpodacus purpureus*) is a new addition to the list of our winter birds, one having been shot on 29th December last. The late Dr. Vancourtland, many years ago, recorded the bird as occurring in January; but the record has hitherto been considered by us to be questionable.

Spring birds, with the dates on which they were first seen in the spring of 1885:

March	8—*Corvus americanus*, Crow, bulk arrived (a few, however, were seen from time to time during the winter.)
"	9—*Octocorus alpestris*, Horned Lark.
April	1—*Molothrus ater*, Cowbird.
"	2—*Carpodacus purpureus*, Purple Finch.
"	6—*Botaurus lentiginosus*, American Bittern.
"	7—*Merula migratoria*, Robin.

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April 7—*Ardea herodias*, Great Blue Heron.
" 8—*Quiscalus quiscula æneus*, Bronzed Grackle.
" 9—*Larus argentatus smithsonianus*, Herring Gull.
" 11—*Melospiza fasciata*, Song Sparrow.
" 11—*Junco hyemalis*, Junco.
" 11—*Spinus tristis*, American Goldfinch.
" 11—*Poocætes gramineus*, Vesper Sparrow.
" 11—*Ammodramus sandwichensis savana*, Savanna Sparrow.
" 11—*Zonotrichia albicollis*, White-throated Sparrow.
" 11—*Sialia sialis*, Bluebird.
" 11—*Tachycineta bicolor*, Tree Swallows.
" 11—*Falco sparverius*, American Sparrow Hawk.
" 12—*Agelæus phœniceus*, Red-winged Blackbird.
" 17—*Scolecophagus carolinus*, Rusty Blackbird.
" 17—*Sayornis phœbe*, Phœbe.
" 17—*Clivicola riparia*, Bank Swallows.
" 18—*Accipiter velox*, Sharp-shinned Hawk.
" 18—*Accipiter cooperi*, Cooper's Hawk.
" 19—*Sturnella magna*, Meadow Lark.
" 19—*Turdus fuscescens*, Wilson's Thrush.
" 19—*Turdus aonalaschkæ pallasii*, Hermit Thrush.
" 20—*Regulus satrapa*, Golden-crowned Kinglet.
" 20—*Passerella iliaca*, Fox Sparrow.
" 20—*Spizella monticola*, Tree Sparrow (first).
" 20—*Ceryle alcyon*, Belted Kingfisher.
" 21—*Chelidon erythrogoaster*, Barn Swallow.
" 21—*Sphyrapicus varius*, Yellow-belled Sapsucker.
" 21—*Colaptes auratus*, Flicker.
" 22—*Anas obscura*, Black Duck.
" 22—*Cyanocitta cristata*, Blue Jay.
" 22—*Spizella socialis*, Chipping Sparrow.
" 22—*Habia ludoviciana*, Rose-breasted Grosbeak.
" 22—*Piranga erythromelas*, Scarlet Tanager.
" 22—*Progne subis*, Purple Martin.
" 23—*Lophodytes cucullatus*, Hooded Merganser.
" 23—*Gallinago delicata*, Wilson's Snipe.
" 23—*Actitis macularius*, Spotted Sandpiper.
" 23—*Falco columbarius*, Pigeon Hawk.
" 23—*Pandion haliaëtus carolinensis*, American Osprey.
" 23—*Regulus calendula*, Ruby-crowned Wren.
" 25—*Aix sponsa*, Wood Duck.
" 25—*Buteo latissimus*, Broad-winged Hawk.
" 25—*Myiarchus crinitus*, Crested Fly-catcher.
" 26—*Zonotrichia leucophrys*, White-crowned Sparrow.
" 26—*Troglodytes aëdon*, House Wren.
" 27—*Charitonetta albeola*, Buffle-head.
" 28—*Spizella monticola*, Tree Sparrow (abundant).

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May 2—*Spizella monticola* Tree Sparrow (last seen).
" 4—*Merganser americanus*, American Merganser.
" 4—*Dendroica virens*, Black-throated Green Warbler.
" 5—*Colymbus auritus*, Horned Grebe.
" 5—*Colymbus holbœllii*, Holbœll's Grebe.
" 6—*Chætura pelasgica*, Chimney Swift.
" 6—*Petrochelidon lunifrons*, Cliff Swallow.
" 6—*Clivicola riparia*, Bank Swallow.
" 6—*Dendroica coronata*, Myrtle Warbler.
" 7—*Mniotilta varia*, Black and White Warbler.
" 7—*Dendroica cœrulecens*, Black-throated Blue Warbler.
" 7—*Compsothlypis americana*, Parula Warbler.
" 7—*Dendroica vigorsii*, Pine Warbler.
" 7—*Setophaga ruticilla*, American Redstart.
" 7—*Sylvania pusilla*, Wilson's Warbler.
" 8—*Dendroica blackburniæ*, Blackburnian Warbler.
" 8—*Zonotrichia leucophrys*, White-crowned Sparrow (last).
" 9—*Geothlypis trichas*, Maryland Yellow-throat.
" 9—*Totanus melanoleucus*, Greater Yellow-legs.
" 9—*Totanus flavipes*, Yellow-legs.
" 10—*Ectopistes migratorius*, Passenger Pigeon.
" 10—*Galeoscoptes carolinensis*, Catbird.
" 10—*Turdus mustelinus*, Wood Thrush.
" 11—*Anas discors*, Blue-winged Teal.
" 11—*Porzana carolina*, Sora.
" 11—*Seiurus noveboracensis*, Water Thrush.
" 12—*Dendroica maculosa*, Magnolia Warbler.
" 13—*Dendroica æstiva*, Yellow Warbler.
" 13—*Dolichonyx oryzivorus*, Bobolink.
" 13—*Tyrannus tyrannus*, Kingbird.
" 14—*Empidonax minimus*, Least Fly-catcher.
" 14—*Icterus galbula*, Baltimore Oriole.
" 14—*Harporhynchus rufus*, Brown Thrasher.
" 16—*Vireo olivaceus*, Red-eyed Vireo.
" 17—*Seiurus aurocapillus*, Oven-bird.
" 18—*Sylvania pusilla*, Wilson's Warbler (last).
" 19—*Oidemia deglandi*, White-winged Scoter.
" 19—*Clangula hyemalis*, Old Squaw.
" 19—*Vireo solitarius*, Blue-headed Vireo.
" 19—*Dendroica castanea*, Bay-breasted Warbler.
" 19—*Tringa minutilla*, Least Sand-piper.
" 20—*Vireo gilvus*, Warbling Vireo.
" 20—*Antrosomus vociferus*, Whip-poor-will.
" 20—*Chordeiles virginianus*, Nighthawk.
" 20—*Melanerpes erythrocephalus*, Red-headed Woodpecker.
" 21—*Dendroica coronata*, Myrtle Warbler (last.)
" 21—*Sylvania canadensis*, Canadian Warbler.

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May 22—*Agelaius phœniceus*, Red-winged Blackbird.
" 22—*Coccyzus erythrophthalmus*, Black-billed Cuckoo.
" 22—*Dendroica pensylvanica*, Chestnut-sided Warbler.
" 22—*Ampelis cedrorum*, Cedar Waxwing.
" 24—*Ægialitis vocifera*, Killdeer.
" 25—*Trochilus colubris*, Ruby-throated Hummingbird.
" 25—*Empidonax flaviventris*, Yellow-bellied Flycatcher.
June 7—*Sterna hirundo*, Common Tern.
" 7—*Dendroica tigrina*, Cape May Warbler.

The summer birds were last seen in 1885 on the following dates:—

August 25—*Progne subis*, Purple Martin.
" 25—*Petrochelidon lunifrons*, Cliff Swallow.
" 26—*Trochilus colubris*, Ruby-throated Hummingbird.
" 27—*Dendroica maculosa*, Magnolia Warbler.
" 27—*Vireo philadelphicus*, Philadelphia Vireo.
" 27—*Seiurus aurocapillus*, Ovenbird.
" 28—*Colaptes auratus*, Flicker.
" 29—*Dendroica blackburniæ*, Blackburnian Warbler.
" 29—*Tyrannus tyrannus*, Kingbird.
" 29—*Chelidon erythrogaster*, Barn Swallow.
" 29—*Clivicola riparia*, Bank Swallow.
" 29—*Sphyrapicus varius*, Yellow-bellied Sapsucker.
Septemb'r 5—*Chætura pelasgica*, Chimney Swift.
" 9—*Sylvania canadensis*, Canadian Warbler.
" 10—*Setophaga ruticilla*, American Redstart.
" 10—*Dendroica castanea*, Bay-breasted Warbler.
" 10—*Dendroica æstiva*, Yellow Warbler.
" 10—*Dendroica virens*, Black-throated Green Warbler.
" 12—*Dendroica pensylvanica*, Chestnut-sided Warbler.
" 12—*Mniotilta varia*, Black and White Warbler.
" 12—*Coccyzus erythrophthalmus*, Black-billed Cuckoo.
" 12—*Melanerpes erythrocephalus*, Red-headed Woodpecker.
" 12—*Chordeiles virginianus*, Nighthawk.
" 13—*Vireo solitarius*, Blue-headed Vireo.
" 13—*Dendroica vigorsii*, Pine Warbler.
" 13—*Geothlypis trichas*, Maryland Yellow-throat.
" 13—*Galeoscoptes carolinensis*, Catbird.
" 13—*Harporhynchus rufus*, Brown Thrasher.
" 15—*Sylvania pusilla*, Wilson's Warbler.
" 16—*Icterus galbula*, Baltimore Oriole.
" 16—*Sayornis phœbe*, Phœbe.
" 17—*Larus philadelphia*, Bonaparte's Gull.
" 20—*Gallinago delicata*, Wilson's Snipe.
" 24—*Piranga erythromelas*, Scarlet Tanager.
" 24—*Dendroica striata*, Black-poll Warbler.
" 27—*Helminthophila celata*, Orange-crowned Warbler.

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Sept'mb'r 29—*Scolecophagus carolinus*, Rusty Grackle.
" 29—*Dendroica palmarum*, Palm Warbler.
" 29—*Aegialitis semipalmata*, Semipalmated Plover.
October 2—*Tringa alpina pacifica*, Red-backed Sandpiper.
" 2—*Actitis macularia*, Spotted Sandpiper.
" 2—*Nycticorax nycticorax nævius*, Black-crowned Night Heron
" 8—*Quiscalus quiscala æneus*, Bronzed Grackle.
" 9—*Troglodytes aëdon*, House Wren.
" 11—*Melospiza georgiana*, Swamp Sparrow.
" 12—*Sturnella magna*, Meadowlark.
" 12—*Troglodytes hiemalis*, Winter Wren.
" 12—*Turdus fuscescens*, Wilson's Thrush.
" 13—*Accipiter atricapillus*, American Goshawk.
" 14—*Vireo olivaceus*, Red-eyed Vireo.
" 16—*Compsothlypis americana*, Parula Warbler.
" 17—*Buteo lineatus*, Red-shouldered Hawk.
" 17—*Falco columbarius*, Pigeon Hawk.
" 17—*Spizella socialis*, Chipping Sparrow.
" 17—*Anthus pensilvanicus*, American Pipit.
" 19—*Zonotrichia albicollis*, White-throated Sparrow.
" 19—*Ammodramus sandwichensis savanna*, Savanna Sparrow.
" 21—*Anas discors*, Blue-winged Teal,
" 21—*Erismatura rubida*, Ruddy Duck.
" 21—*Fulica americana*, American Coot.
" 22—*Dendroica caerulescens*, Black-throated Blue Warbler.
" 22—*Turdus aonalaschkæ pallasii*, Hermit Thrush.
" 23—*Ampelis cedrorum*, Cedar Waxwing.
" 23—*Philohela minor*, American Woodcock.
" 24—*Botaurus lentiginosus*, American Bittern.
" 25—*Regulus satrapa*, Golden-crested Kinglet.
" 26—*Anas carolinensis*, Green-winged Teal.
" 27—*Circus hudsonius*, Marsh Hawk.
" 27—*Passerella iliaca*, Fox Sparrow.
" 29—*Branta canadensis*, Canada Goose.
" 29—*Tringa maritima*, Purple Sandpiper.
" 29—*Tringa fuscicollis*, White-rumped Sandpiper.
" 30—*Corvus americanus*, American Crow (some, however, were seen from time to time all winter).
" 30—*Anas strepera*, Gadwall.
" 30—*Aix sponsa*, Wood Duck.
" 31—*Charadrius apricarius*, Golden Plover.
" 31—*Regulus calendula*, Ruby-crowned Kinglet.
November 1—*Ardea herodias*, Great Blue Heron.
" 3—*Gallinago delicata*, Winson's Snipe.
" 12—*Larus argentatus smithsonianus*, American Herring Gull.
" 12—*Oidemia perspicillata*, Surf Scoter.

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Nov'mb'r 12—*Archibuteo lagopus sancti-johannis*, American Rough-legged Hawk (probably with us all winter).
" 12—*Ceophlœus pileatus*, Pileated Woodpecker (with us all winter).
" 15—*Totanus melanoleucus*, Greater Yellow-leg.
" 15—*Junco hyemalis*, State-colored Junco.
" 24—*Merula migratoria*, American Robin.
" 26—*Merganser americanus*, American Merganser.
" 26—*Ceryle alcyon*, Belted Kingfisher.
" 26—*Melospiza fasciata*, Song Sparrow.
" 26—*Clangula hyemalis*, Old-Squaw.
December 5—*Certhia familiaris americana*, Brown Creeper (a few probably with us all winter).
" 12—*Accipiter velox*, Sharp-shinned Hawk.
" 28—*Spinus tristis*, American Goldfinch.
" 20—*Carpodacus purpureus*, Purple Finch.

The winter birds were first seen last fall (1885) on the following dates:—

August 26—*Loxia curvirostra minor*, American Crossbill.
October 31—*Plectrophenax nivalis*, Snowflake.
December 1—*Loxia curvirostra minor*, American Crossbill.
" 29—*Lanius borealis*, Northern Shrike.

W. L. SCOTT,
JOHN MACOUN.
GEO. R. WHITE,
Leaders.

18th February, 1886.

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REPORT OF THE BOTANICAL BRANCH.

To the Council of the Ottawa Field Naturalists' Club:

The work in this branch has been continued on the plan of former years, the Saturday afternoon outings and the regular club excursions bringing the members together for systematic work and instruction. In the early summer the attendance on Saturday afternoon was augmented by the presence of a large number of pupils of the public schools under the care of Mr. Robert B. Whyte. They constituted a class which had been conducted by this gentleman during the winter, and he concluded his work by a series of demonstrations in the field.

Of the club excursions the most productive for the Botanists was the one to Casselman, where the greater number of the additions to the list were obtained.

A plant worthy of mention gathered in the district, but at too great a distance from Ottawa to be included in the local list, is *Cnicus altissimus*, Willd, var. *discolor*, which was found by Mr. Ami at St. Philippe, Que.

The plants added to our catalogue during the past season number 19, which indicates a continued activity and vigilance among the members. Those most worthy of notice are *Corallorhiza striata*, *Aplectrum hyemale*, and *Carex arcta*.

Hitherto our catalogue has included only flowering plants and ferns, although some of the workers have devoted their attention to cryptogamic botany. This year we are enabled to add a list of Mosses prepared by Professor Macoun. With the exception of a few species collected by Mr. Fletcher and indicated in the list, all were collected by the Professor himself, and all the specimens mentioned have been submitted to him for indentification. We trust it will facilitate the work of those who have already commenced, and that it will induce others to begin, this very attractive branch of Botany.

R. B. WHYTE.
JOHN MACOUN.
BEAUMONT SMALL, M.D.

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Flora Ottawaensis.

Additions, 1885.

Ranunculus multifidus, Pursh var. repens, Watson, Gatineau Point, July —Prof. Macoun.

Viola cucullata Ait. var. cordata, Gr. McKay's wood, May—Prof. Macoun.

Solidago rugosa, Mill, common, August—Mr. Fletcher.

Aster Novæ-Angliæ, L. Casselman, August— Miss Nellie Macoun.

Aster Lindleyanus, T. & G. St. Louis Dam—Mr. Fletcher.

Lactuca leucophæa, Stewart's Bush—Mr. Fletcher.

Lophanthus nepetoides, Benth. Casselman, August—Mr. Fletcher.

Callitriche autumnalis, L. Brigham's Creek, August—Prof. Macoun.

Salix purpurea, L. Billings Bridge, May—Mr. J. M. Macoun.

Salix balsamifera, Barratt Patterson's Creek, May—Mr. J. M. Macoun.

Corallorhiza striata, Benth. New Edinburgh—Miss C. L. Hanington.

Aplectrum hyemale, Nutt., McKay's wood—Col. White.

Sparganium simplex, Huds. var. androcladum, Gray. Casselman, August —Prof. Macoun.

Juncus alpinus, Villars. var. insignis, Fries. Casselman, August—Prof. Macoun.

Juncus pelocarpus, E. Meyer, Britannia, September—Prof. Macoun.

Carex arcta, Boot, Gatineau Point, August—Prof. Macoun.

Carex pubescens, Muhl., Stewart's Bush, May—Mr. Fletcher.

Carex tentaculata, Muhl., Casselman, August—Prof. Macoun.

Carex trichocarpa, var. imberbis Gr.—Mr. R. B. Whyte.

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LIST OF MOSSES COLLECTED IN THE NEIGHBORHOOD OF OTTAWA.

By John Macoun, M.A., F.R S.C., F.L.S.

1. Sphagnum acutifolium, Ehrh.—Common in peat bogs.—Dow's swamp. Oct., 1884. Mer Bleue. Lake Flora.

2. Sphagnum Wulfianum, Girgens.—Peat bogs and cedar swamps. —Mer Bleue. (Fletcher).

3. Sphagnum cymbifolium, Ehrh.—Peat bogs and swamps.—Dow's swamp. Oct., 1884. Mer Bleue. Lake Flora.

4. Cynodontium virens, Schimp. var. Wahlenbergii—Rotten logs in thick damp woods—Woods near Ironsides; also at the mines on the River Lievre. May 19, 1885.

5. Dicranella varia, Schimp.—On damp earth along ditches. Ditch along the railway south of St. Louis Dam. May, 1885.

6. Dicranella heteromalla, Schimp.—On damp sandy banks and on turned up stumps in woods.—McKay's woods; also Skead's farm, Richmond Road. May 12, 1885.

7. Dicranum montanum, Hedw.—On the bases of trees and stumps. McKay's woods, without fruit; fruiting at the mines on the Lievre. May 19, 1885.

8. Dicranum viride, Schimp. On the bases of trees in woods. McKay's woods; also at the mines on theLievre. May 18, 1885. Always without fruit.

9. Dicranum flagellare, Hedw.—On rotten logs in woods.—Dow's swamp; Skead's farm, Richmond Road. May 9, 1885.

10. Dicranum fulvum, Hook.—On boulders in woods.—Woods at the phosphate mines on the Lievre. Rare. May 19, 1885.

11. Dicranum scoparium, Hedw.—On earth and old logs in woods. Common everywhere.

12. Dicranum Schraderi, Web. and Mohr.—Peat bogs and swamps. Dows' swamp. Oct., 1884.

13. Dicranum undulatum, Turn.—Logs and earth in damp woods. At the phosphate mines on the Lievre. May 19, 1885.

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14. Dicranum spurium, Hedw.—On dry rocks and at the bases of trees in dry places. Rockcliffe. (Fletcher).

15. Fissidens bryoides, Hedw.—On earth on mounds in woods.—In woods west of Mr. J. Lorne McDougall's house, Hintonburgh. May 9, 1885.

16. Fissidens minutulus, Sulliv.—On stones and damp earth in the beds of dry water-courses.—McKay's woods and beyond the toll gate, by the C.P.R. crossing on the Aylmer Road. In fruit in October.

17. Fissidens osmundoides, Hedw.—Roots of trees in swamps. Dows' swamp; also in wet woods at Carleton Place. May 30, 1884.

18. Fissidens adiantoides, Hedw.—Roots of trees, old stumps and on stones in damp woods around Ottawa; common.

19. Leucobryum vulgare, Hampe.—On earth in damp woods.—Gilmour's Island, Chelsea, and at Lake Flora, Hull. (Fletcher).

20. Ceratodon purpureus, Brid.—Abundant on earth and rocks in woods and fields, or by roadsides, also on walls and roofs of houses; very common.

21. Seligeria pusilla, Bruch. and Schimp.—On the damp surface of limestone rocks, two miles from Hull; our smallest and rarest moss.

22. Barbula unguiculata, Hedw.—On earth along roadsides.—Common; abundant on Park Avenue (Oct., 1884) and at St. Louis Dam.

23. Barbula convoluta, Hedw.—On earth in pastures.—Carleton Place and in pastures west of Rochesterville (May, 1885).

24. Barbula tortuosa, Web. and Mohr.—On limestone rocks and ledges in woods.—Ironsides, west of Chelsea road (Oct., 1884); on rocks north of Hull (May, 1885).

25. Barbula ruralis, Hedw.—Dry rocks and sterile ground.—Nepean point (Oct., 1884) and ledges along the Ottawa; McKay's woods (May, 1885).

26. Leptotrichum tortile, Muell.—On earth along the roadside near Buckingham village; very rare. (May, 1885).

27. Didymodon rubellus, Bruch. and Schimp.—Crevices of rocks along streams.—West of Chelsea Road, Ironsides (Oct., 1884), and in woods north of Hull (May, 1885).

28. Grimmia apocarpa, Hedw.—Common on limestone and other boulders.—Rocks west of Hull (Oct., 1884), and near Hintonburgh (May, 1885).

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29. Hedwigia ciliata, Ehrh.--Abundant on boulders everywhere. McKay's Lake (May, 1884). Hull. Billing's Bridge. Chelsea.

30. Hedwigia ciliata, Ehrh. var. viridis, Schimp.—On boulders in shady places.—Rockcliffe (Fletcher).

31. Orthotrichum anomalum, Hedw.—On limestone rocks in woods along the creek west of Hull (May, 1885); apparently rare.

32. Orthotrichum sordidum, Sulliv. and Lesq.—On trees, generally in wooded swamps.—In woods near Ironsides (October, 1884). Hintonburg (May, 1885). Rockcliffe, (1882.)

33. Orthotrichum Ohioense, Sulliv. and Lesq.—On trees in woods; McKay's Lake, May, 1885; Hull, P.Q. Rare.

34. Orthotrichum brachytrichum, Schimp.—On Ash trees generally; on trunks along the Chelsea road (October, 1884) and in woods, Skead's farm, Richmond road; McKay's woods (May, 1885).

35. Orthotrichum strangulatum, Beauv.—On trees and fences.—On trunks along the Chelsea road (October 1884); on trees, Skead's farm, Richmond road, and in McKay's woods (May, 1885).

36. Orthotrichum leiocarpum, Bruch. and Schimp.—On trees in swamps.—On Balsam and Spruce trees along the Chelsea road (October, 1884), also west of Skead's farm, Richmond road (May, 1885).

37. Encalypta ciliata, Hedw.—In crevices of rocks in ravines. On ledges along the creek west of Hull (October, 1884), also very abundant at Rockcliffe, at McKay's Lake, and along the Ottawa (May, 1885).

38. Tetraphis pellucida, Hedw.—On rotten stumps in damp woods.—Dow's swamp (October, 1884). South of Hintonburg, and at McKay's Lake (May, 1885).

39. Physcomitrium pyriforme, Brid.--On damp earth in exposed places.—Metcalfe street, Stewarton (Fletcher).

40. Funaria hygrometrica, Sibth.—On earth by old burnt log heaps, borders of woods. Common.

41. Bartramia Œderiana, Swartz.—Damp rocks in ravines. Hull (October, 1884), and at McKay's Lake and Rockcliffe (May, 1885).

42. Bartramia pomiformis, Hedw.—Crevices and faces of damp rocks in woods.—Ironsides; King's mountain; along the Aylmer road (October, 1884) and at McKay's Lake (May, 1885).

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43. Philonotis fontana, Brid.—Along ditches and around springs. Bank of Rideau river, below the Hog's Back (Fletcher).

44. Leptobryum pyriforme, Schimp.—On earth in burnt swamps or wet woods.—Dow's swamp (October, 1884), also at McKay's Lake (May, 1885).

45. Bryum pendulum, Schimp.—On earth in woods and on wet rocks along streams.—Rockcliffe (Fletcher).

46. Bryum intermedium, Brid.—Crevices of damp rocks; on ledges in McKay's woods (May, 1885).

47. Bryum bimum, Schreb.—Wet swampy woods; common. Swamp in McKay's woods (May, 1885).

48. Bryum argenteum, Linn.—On earth and dry rocks, chiefly by roadsides, common. St. Louis' Dam (October, 1884)

49. Bryum cæspiticium, Linn.—On dry and exposed soil.—Rockcliffe (Fletcher).

50. Bryum roseum, Schreb.—On old logs in woods, rare in fruit. McKay's woods, and south of Hintonburg (May, 1885).

51. Mnium cuspidatum, Hedw.—Very abundant on damp earth and stones in woods. Common everywhere (May, 1885).

52. Mnium affine, Bland.—On earth in swamps and by brooks. Dow's swamp (October, 1884), also on logs by a pond at the phosphate mines, Lievre River, and at McKay's Lake (May, 1885).

53. Mnium lycopodioides, Schwaegr.—On the bases of trees in swamps and on damp rocks.—Dow's swamp (October, 1884), in woods at the phosphate mines, Lievre River, and at McKay's Lake (May, 1885).

54. Mnium stellare, Reichard.—On roots of trees in shady wet places.—Dow's swamp (October, 1884), also in swamps south of Hintonburgh (May, 1885).

55. Mnium punctatum, Hedw.—On earth in swamps; Dow's swamp (October, 1884).

56. Aulacomnion palustre, Schwaegr.—In swamps and wet woods. Dow's swamp (October, 1884).

57. Timmia megapolitana, Hedw.—On the roots of trees in swamps and on faces of damp rocks in ravines.—Dow's swamp (October, 1884), also along McKay's Lake (May, 1885).

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58. Atrichum undulatum, Beauv.—On sandy hummocks in damp woods; McKay's woods (Oct., 1884), and in Skead's woods, Richmond Road (May, 1885).

59. Polytrichum juniperinum, Willd.—On the bases of stumps and in sandy fields; common in all suitable places.

60. Polytrichum piliferum, Schreb.—On barren ground, chiefly on rocks.—Gilmour's Island and King's Mountain, Chelsea, P.Q. (Fletcher).

61. Buxbaumia aphylla, Linn.—Upon exposed but damp rocks on the north side of Gilmour's Island, Chelsea (May 4 1881); very rare. (Fletcher).

62. Fontinalis antipyretica, Linn.—On stones and sticks in streams.—In the stream running out of Fairy Lake, through the beaver meadow, Hull, P. Q. (Fletcher).

63. Dichelyma pallescens, Bruch. and Schimp.—On dead sticks in pools.—In pasture fields near St. Patrick's bridge, Ottawa; rare. (Oct., 1884).

64. Neckera pennata, Hedw.—On trunks in damp woods.—Quite common; McKay's Lake (May, 1885).

65. Homalia trichomanoides, Bruch. and Schimp.—On the bases of trees and on rocks in ravines.—On trees, Skead's farm, Richmond road, and on rocks, McKay's Lake. (May, 1884).

66. Leucodon sciuroides, Schwaegr.—On trunks of trees in woods.—McKay's woods, near the lake. (May, 1884).

67. Leucodon julaceus, Sulliv.—On trunks of trees in woods; rear of Skead's farm, Richmond road; Hull. (May, 1885).

68. Leskea nervosa Myrin.—On the bases of trees in woods. McKay's woods (Oct., 1884), and north of the Aylmer road, (May, 1885).

69. Anomodon rostratus, Schimp.—On the bases of trees and on rocks.—McKay's woods (Oct., 1884), and rear of Skead's farm, Richmond road, (May, 1884).

70. Anomodon apiculatus, Bruch. and Schimp.—On old stumps and decaying logs.—Rear of Skead's farm, Richmond road, (May, 1885).

71. Anomodon attenuatus, Hueben.—On rocks and at the bases of trees in swamps.—McKay's woods and Skead's farm. (May, 1884).

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72. Anomodon obtusifolius, Bruch. and Schimp.—On trunks of trees in swamps and wet woods.—McKay's Lake, and in rear of Skead's farm, Richmond road, (May, 1885).

73. Anomodon viticulosus, Hook. and Taylor.—On damp rocks in large masses, especially on limestone.—Shaded rocks along the creek beyond the C. P. R. crossing, Hull, P.Q. (Oct., 1884).

74. Platygyrium repens, Bruch. and Schimp.—On old logs in woods; not uncommon.—Dow's swamp, (Oct., 1884), also Skead's and McKay's woods, (May, 1885).

75. Pylaisia polyantha, Bruch. and Schimp.—On trees, especially poplar.—McKay's woods; rare. (Oct., 1884).

76. Plyaisia intricata, Bruch. and Schimp.—On trees, logs and fences; common.—Very abundant on fences, Richmond road, (May, 1885), also at Ironsides, (Oct., 1884).

77. Pylaisia velutina, Bruch. and Schimp.—On trees and logs, apparently rare.—McKay's Lake, (May, 1885).

78. Cylindrothecium cladorrhizans, Schimp.—In woods on decaying logs; not common.—Rotten logs, McKay's Lake, and rear of Skead's farm. (May, 1885).

79. Climacium Americanum, Brid.—In wet woods or swamps on the ground or decaying logs, McKay's woods, (Oct., 1884), and in a swamp north of the Aylmer road (May, 1885); Powell's grove, near the creek; in fruit. (1879 Fletcher.)

80. Hypnum (Thuidium) minutulum, Hedw.—On old logs and stumps in swamps or wet woods.—Dow's swamp (Oct., 1884); at McKay's Lake, and north of the Aylmer road, beyond Hull. (Mar., 1885).

81. Hypnum (Thuidium) scitum, Beauv.—On the trunks of Beech trees, near the base. McKay's woods and at the phosphate mines on the Lievre river. (May, 1885).

82. Hypnum (Thuidium) gracile, Bruch. and Schimp.—On old logs in thick woods.—Dow's swamp (Oct., 1884), and McKay's woods and rear of Skead's farm (May, 1885).

83. Hypnum (Thuidium) recognitum, Hedw.—On earth in damp woods.—Dow's swamp (Oct., 1884), also in woods at the phosphate mines on the Lievre River, (May, 1885).

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84. Hypnum (Thuidium) delicatulum, Linn.—On earth in swamps. Along the Chelsea road, near Ironsides, (May, 1885).

85. Hypnum (Thuidium) abietinum, Linn.—On dry exposed rocks; not common.—On ledges, along the creek north of Hull. (May, 1885).

86. Hypnum (Thuidium) Blandovii, Web. and Mohr.—Peat bogs and other swamps.—Dow's swamp. (Oct., 1884).

87. Hypnum (Campothecium) nitens, Schreb.—On earth, in peat and other swamps.—Dow's swamp. (Oct., 1884).

88. Hypnum (Brachythecium) lætum, Brid.—On old logs, stones and earth in woods; not uncommon.—Abundant on earth near McKay's Lake and in Skead's woods. (May, 1885).

89. Hypnum (Brachythecium) salebrosum, Hoffm.—On damper soil than the preceding; capsules larger and pedicel longer.—McKay's woods and rear of Skead's farm. (May, 1885).

90. Hypnum (Brachythecium) œdipodium, Mitt.—On the bases of trees in swamps; very rare.—Dow's swamp. (Oct., 1884).

91. Hypnum (Brachythecium) rutabulum, Linn.—On stones and earth in shaded damp places. McKay's woods, near the lake. (May, 1884).

92. Hypnum (Brachythecium) rivulare, Bruch.—On stones and earth in swamps and around springs.—Swamp at St. Louis Dam, Ottawa. (Oct., 1884).

93. Hypnum (Eurhynchium) strigosum, Hoffm.—On earth and stones in woods.—McKay's woods, (Oct., 1884), and in woods along the Aylmer road, (May, 1885).

94. Hypnum (Eurhynchium) diversifolium, Schimp. Ms.—Shady banks in woods. McKay's woods (October, 1884).

95. Hypnum (Eurynchium) hians, Hedw.—Moist banks of brooks in shady woods.—Along a brook west of Mr. J. Lorne McDougall's house, Hintonburg, and in McKay's woods. (May, 1885).

96. Hypnum (Raphidostegium) recurvans, Schwaeger.—On bases of large trees in thick woods.—Abundant. (May, 1885).

97. Hypnum (Rhynchostegium) deplanatum, Schimp.—In thin mats on earth and stones. In the rear of Skead's farm and at McKay's Lake, (May, 1885).

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98. Hypnum (Rhynchostegium) rusciforme, Weis.—On stones in rivers and brooks.—In a brook at the phosphate mines, Lievre river. (May 19, 1885).

99. Hypnum (Thamnium) Alleghaniense, Muell.—In crevices of rocks, damp ravines, limestone rocks.—McKay's Lake, May, 1885).

100. Hypnum (Plagiothecium) turfaceum, Lind.—On the top of old rotten stumps, and on logs in shady damp woods.—Dow's swamp (Oct., 1884). also on the banks of the creek west of Hull, and on stumps at McKay's Lake. (May, 1885).

101. Hypnum (Plagiothecium) denticulatum, Linn.—On old logs and hummocks in swamps.—Dow's swamp (October, 1884).

102. Hypnum (Plagiothecium) Sullivantiæ, Schimp.—In crevices of rocks and on shady banks in woods.—At the phosphate mines on the Lievre River and at McKay's Lake (May, 1885).

103. Hypnum (Plagiothecium) sylvaticum, Huds.—On shaded, steep rocks in woods and also on logs, near Ironsides, Chelsea road, and on rocks north of Hull (October, 1884), also on rocks McKay's Lake (May, 1885).

104. Hypnum (Amblystegium) confervoides, Brid.—In thin mats on flat limestone rocks.—On ledges in woods west of Mr. J. Lorne McDougall's house, Hintonburgh, also in same situation north of Hull (May, 1885).

105. Hypnum (Amblystegium) serpens, Linn.—On rotten wood, earth and stones, common.—Dow's swamp (October, 1884); frequent in McKay's woods (May, 1885).

106. Hypnum (Amblystegium) adnatum, Hedw.—On stones and at the base of trees in woods; McKay's woods (October, 1884).

107. Hypnum (Amblystegium) compactum, Muell.—On the bases of trees in swamps.—Carleton Place (May, 1884).

108. Hypnum (Amblystegium) riparium, Linn.—On sticks, stones and decayed logs in wet woods.—Wet places near St. Patrick's Bridge, Ottawa (October, 1884).

109. Hypnum (Campylium) hispidulum, Brid.—On stones and roots of trees.—Carleton Place (May, 1884), also in woods north of the Aylmer road and at McKay's Lake (May, 1885).

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110. Hypnum (Campylium) chrysophyllum, Brid.—On the bases of trees and on steep rocks in ravines; in woods along the Chelsea road (October, 1884), in woods at the phosphate mines on the Lievre River (May, 1885), and at Rockcliffe.

111. Hypnum (Harpidium) aduncum, Hedw.—In swamps and marshes.—Dow's swamp (October, 1884).

112. Hypnum (Harpidium) Kneiffii, var. laxum, Mild.—In bogs and swamps.—Dow's swamp (October, 1884).

113. Hypnum (Harpidium) uncinathum, Hedw.—Quite common in swamps, ditches and bogs. Dow's swamp (October, 1884).

114. Hypnum (Rhytidium) rugosum, Linn.—On exposed rocks along rivers.—Rockcliffe (Fletcher).

115. Hypnum (Ctenium) crista—castrensis, L.—On old logs and earth in swamps.—Dow's swamp (October, 1884), also in thick woods north of Hull (May, 1885).

116. Hypnum reptile, Michx.—On bark and trunks of trees. McKay's woods and wood north of Hull (May, 1885).

117. Hypnum imponens, Hedw.—On decayed logs in shady woods.—Woods near Ironsides, Chelsea road (October, 1884); rear of Skead's farm and at McKay's lake (May, 1885).

118. Hypnum Haldanianum, Grev.—On decaying trunks and damp earth in woods.—Very common around Ottawa (October, 1884).

119. Hypnum (Calliergon) cordifolium, Hedw.—Cedar and other swamps.—Dow's swamp (October, 1884).

120. Hypnum (Calliergon) cuspidatum, Linn.—In cedar and other swamps.—Dow's swamp (October, 1884).

121. Hypnum (Pleurozium) splendens, Hedw.—On earth in cool woods and swamps.—Dow's swamp (October, 1884); Billing's Bridge and Hull, P.Q.

122. Hypnum (Pleurozium) Oakesii, Sulliv.—On stones and earth along a brook at the phosphate mines, Lievre River (May, 1885).

123. Hypnum (Hylocomium) triquetrum, Linn.—On earth and moss in woods.—Dow's swamp (October, 1884), also in woods at the phosphate mines, Lievre River (May, 1885).

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Abstract of Meteorological Statistics at Ottawa, June 1885 to May 1886, inclusive, by A. McGill, M.A.

	Months.												Year.
	1885.							1886.					
	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feby.	Mar.	Apr.	May	
Average height of barometer at 32° and reduced to sea level	29·888	29·897	29.934	29·998	30·000	29·918	29 959	30·057	30·047	29·925	30.117	29·860	29·967
Highest barometer	30·190	30·203	30.208	30·335	30 357	30·369	30 742	30·719	30·583	30·520	30·607	30·191	30·742
Lowest barometer	29·485	29·621	29.514	29·423	29·471	29·481	29·078	29·082	29·122	29·341	29·480	29 451	29·078
Monthly and annual ranges	0·705	0·582	0.694	0·912	0·886	0·888	1 664	1·637	1·461	1·179	1·127	0·740	1·664
	°	°	°	°	°	°	°	°	°	°	°	°	°
Average temperature of the air	63·05	69·37	62·39	54·93	43·87	32·84	17·49	10·51	10·55	24·44	45·10	55·93	40·87
Difference from average (10 years)	—3·05	—0·63	—4·6	—3 07	—4·13	+1·46	+0·99	—0·30	—1·45	+3·12	+7·30	—1·90	—0·52
Highest temperature	82·2	88·1	83·01	70·4	70·8	50·0	40·8	37·0	38·1	43·3	79·7	75·0	88·1
Lowest temperature	38·7	49·0	40 8	30·0	19·9	4·4	—10·6	—26·5	—22·5	—15·8	11·7	34·9	—26·5
Monthly range	43·5	39·1	42·2	49·4	59 9	45·6	51·4	63·5	60·6	59 1	68·0	40·1	1.4·6
Average maximum temperature	72·72	77·94	71·72	65·18	51·27	36·24	24·26	17·47	19·72	30·73	54·85	64·87	.....
" minimum temperature	50·23	57·55	50·72	42·61	35·17	26·60	7·85	2·28	1·97	14·92	32·01	44·89	.....
" daily range	22·49	20·39	21.00	22 57	16·10	9·64	16·41	15·19	17·75	15·81	22·84	19 98	18·35
Average pressure of vapour	0·426	0.592	0 481	0·378	0·256	0·176	0·098	0·077	0·084	0·114	0·243	0·306	0·269
Average humidity of the air	72	82	84	84	85	92	89	87	91	81	75	69	82
" temperature of the dew point	54·6	63.8	57·9	51·3	40·9	31·2	18·0	12·7	14·5	21·2	39·5	45·6	42·2
Amount of rain in inches	2 62	2·73	1·91	3·18	3·19	2·49	0·14	0·89	0·31	2 12	0·75	1·74	22·07
Difference from average (10 years)	+0·54	+0·83	+0·10	+0·37	+0·66	+1·24	—0·38	+0·26	—0·37	+1·13	—0·19	—1·05	+3 14
Number of days of rain	11	11	10	11	12	11	3	4	2	3	6	12	96
Amount of snow in inches	.....	.....	.....	.....	0·8	11·4	28 0	30·3	18·9	16·0	10·0	.....	115·3
Difference from average (10 years)	.....	.....	.....	.....	—1·2	+0·9	+0·1	+8·4	+0.5	—4·3	+6·3	—0·1	+10·6
Number of days of snow	.....	.....	.....	.....	1	8	10	13	14	10	3	.....	59
Percentage of sky clouded	45	51	55	38	61	80	69	64	57	61	45	45	56
Average velocity of wind	7·57	4·87	4·90	4·77	5·86	6·37	6·56	7·18	.....	6·77	5·01	5 55	.....

Auroras. No observations taken.

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